THE EPIDEMIOLOGY OF HAIRSTYLE RELATED AFRICAN HAIR DISORDERS, IN AN URBAN TOWNSHIP IN SOUTH AFRICA

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Dedication

This thesis is dedicated to my daughters Vuyi and Gugu Mayosi for understanding when mama cannot do what other mothers do. I am almost back and yes "no more studying".

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Declaration

The contents of the thesis reflect original work conducted by Nonhlanhla P Khumalo. Sections of the systematic review, background and discussions that mention other people's work are referenced accordingly.

Parts of this dissertation have been published (or submitted) as follow: [1-6]

Chapter 1. Khumalo NP. Yes, let's abandon race--it does not accurately correlate with hair form. *J Am Acad Dermatol* 2007;**56**(4)**:**709-10 (letter).

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Abstract

Background

The hair of indigenous people of Africa varies from the north to the south of the continent. Although the variation in hair colour from light brown to black occurs, the most significant difference is in the curls which are tightest, and spiral, in indigenous sub Saharan Africans. African hair for the purpose of this thesis refers to the latter hair phenotype. The unique morphology of this hair type is associated with specific responses to grooming. In addition hairstyle preferences may be influenced by politics and fashion.

Specific scalp disorders have been anecdotally reported to be more prevalent in Africans. These are acne (folliculitis) keloidalis (AKN), central centrifugal cicatricial alopecia (CCCA) and traction alopecia (TA). For many years all these conditions have been suspected to have a causal association with hairstyles. However, preliminary investigation suggested a lack of population studies demonstrating the latter association. In addition the possible influence of the unique African hair follicle on disease pathogenesis had not been determined.

The aims of this thesis were to:

1. Present a systematic literature review of published prevalence and incidence data on the above three conditions.
2. Conduct cross sectional studies to investigate the prevalence of AKN, CCCA and TA in a population of school children and adults and the prevalence of different hairstyles, and to describe any associations between hairstyles and disease.
3. Develop and test for reliability a new severity scoring system for TA the commonest of the above conditions [the marginal traction alopecia severity (M-TAS) scoring instrument].
4. Evaluate the determinants of both TA presence and severity in African females using data from our cross sectional studies in school children and adults.

Results

The systematic review identified only three studies estimating the prevalence of the conditions of interest in this thesis. The prevalence was 1% for TA and ranged from 1.3% to 13.7% for AKN. Two of the studies were performed in clinics in Europe and Africa; and the third was an

American study conducted among football players. None of the studies were performed in a general population and no study reported the prevalence or incidence of CCCA.

In our study the prevalence of AKN was 4.7% in boys in the last year of high school and 10% in adult males. AKN was lower in the age group >75 years than the 50 – 75 years and was associated with haircut symptoms including bleeding. CCCA was not diagnosed in school children and was highest in females in the age group 50 – 75 years. TA prevalence in school children was 17.1% in girls, and increased with age from 8.6% in the first year of junior school to 21.7% in last year of high school. Even though school rules restricted the variety of hairstyles, an association between TA prevalence and hairstyles was demonstrated, being higher in participants with relaxed long vs. natural short hair (19.4% vs. 1.4% respectively).

In adults the TA prevalence was 31.7% in females vs. 2.3% in males and was associated with hairstyle. While a similar prevalence was demonstrated in natural hair (24.8%) and permed hair (22.8%), the prevalence was higher in long (straight) relaxed hair (33.6%) and in combined hair styles (i.e. natural/relaxed/perm + braids/extensions/weaves) (40%). The traction applied to long straight hair is intermittent, i.e. back combing, tying hair into ponytail for a day whereas in combined hairstyles traction is usually applied for more than two weeks (braids, extensions and weaves). Permanently waved and s-curled hair is usually styled loosely which may explain the lower prevalence of disease than that associated with relaxed long hair. The TA prevalence was highest (48%) where long term traction (braid extensions, weaves) was applied to relaxed hair.

The M-TAS score instrument was developed and evaluated using an examiner assessed system (tested once) or a picture matched score (tested twice). The photograph based M-TAS score was found to be more reliable but requires validation with larger numbers.

The determinants of TA presence were estimated in females, the gender most affected by TA, using data from above population studies. More girls had chemically treated hair than women. The odds ratio (OR) for TA presence was higher in adults than children [1.87, 95% Confidence Interval (CI) 1.28 – 2.72. The highest risk of TA presence, compared to natural short hair, occurred when traction was added to relaxed hair [OR 3.47 (CI 1.94 – 6.20)]. TA severity was associated with age group, current hairstyle and hair dressing symptoms. It was not possible to investigate determinants for TA severity because of the small number of participants with

severe disease.

Limitations and conclusions

There is a paucity of published data on the scalp conditions of interest in this thesis. The findings of the adult study are likely to be less generalizable than those of the school study, because community groups were used in the former owing to limited funding and this may have introduced selection bias. We have demonstrated that TA/CCCA and AKN are common in African females and males respectively and that these diseases are more common in adults than children.

Although AKN was associated with haircut symptoms, the influence of frequency of haircut requires further study. In addition haircut symptoms in males, especially bleeding, may have implications for blood borne disease transmission and need further investigation.

CCCA may be associated with hair relaxed for longer than 5 years and its association with hairdressing requires further study. Both AKN and CCCA are commoner in the age group 50-75 years than in those greater than 75 years which, for scarring conditions, may suggest exogenous influence such as hair style trends rather than a degenerative pathogenesis.

TA was clearly associated with hairstyling. The prevalence was lower in relaxed long straight hair than relaxed hair that had extensions/weaves attached; suggesting that intermittent traction associated with the former maybe less damaging than the prolonged traction of the latter. Similarly disease frequency was higher in traction from artificial extension than that from natural hair and in participants with hairdressing symptoms.

Avoidance of both inducing symptoms during hairdressing and the addition of traction to relaxed hair may thus be important for disease prevention. Studies with larger numbers of participants with severe disease could help in the investigation of determinants of TA severity.

Chapter 1

Background and introduction

Hair is an important part of expressing one's identity. Disease and perceived imperfections in the appearance of the hair and scalp can result in psychological distress and even mental ill health in some people.[1,2] Most people, however, attempt to improve the situation by consulting a hairdresser. Decisions on how to solve a perceived hair problem may also be influenced by current hairstyle trends and the individual's hair type (very curly, straight etc.) Hair type or form determines the behaviour and response of hair to grooming and has been used as one criterion in classifying people into races. Although this chapter is about hair form, in view of its association with skin colour and the use of both in the racial classification of people, a brief discussion on skin colour will precede the discussion of hair in the definition of African hair.

Skin colour and its evolution

The discussion on skin colour and its significance has been on-going for many years. Previously, the commonly held view was that early humans first lost their body hair and then developed pigment as protection against ultra violet (UV) light induced skin cancers. But because skin cancers tend to develop later in life and do not interfere with reproduction, they 'could not have exerted enough evolutionary pressure for its protection alone to account for darker skin colours'.[3] An alternative theory, which is more prevalent, suggests that pigment developed rather as protection against UV induced folate (Vitamin B_6) deficiency. UV exposure results in rapid folate breakdown.[4] Folate is necessary for cell turn over and is crucial in processes such as spermatogenesis and early embryological development particularly of the neural tube.[5] This is the reason why folate deficiency results in developmental abnormalities such as Spina Bifida, a congenital abnormality of the spine associated with reduced survival.[6] Sufferers would be more likely to be naturally selected out of the genetic pool. On the other hand, the skin has to allow enough UV penetration for the conversion of cholesterol to Vitamin D, which is needed for the absorption of calcium, essential for bone development, from the gut.

The skin thus has to strike a balance between being dark enough to limit UV induced folate destruction (thus preserving fertility and foetal neural development) and light enough

to allow enough UV for adequate foetal bone development (thus preventing conditions such as rickets which can also reduce survival). Although the argument is not as straightforward, it provides an attractive theory.

Jablocki and Chaplin reported that '…the earth's surface could be divided into three vitamin D zones: one comprising the tropics, one the subtropics and temperate regions and the last the circumpolar north and south….' In the first, the dosage of UVB throughout the year is high enough that humans have enough opportunity to synthesize Vitamin D all year. In the second, at least one month during the year has insufficient UVB radiation, and in the third area not enough UVB arrives on average during the entire year to prompt Vitamin D synthesis. This distribution could explain why indigenous people of the tropics generally have darker skin, whereas people in the sub tropics and temperate regions are lighter-skinned but have the ability to tan, and those who live in regions near the poles tend to be light-skinned and burn easily.[3,4,7]

In the past the regional differences in phenotype were thought to have arisen separately in different populations, a view that was referred to as the Multiregional Theory of Evolution. Mitochondria are organelles found in the cytoplasm and function not only as the energy store house for the cell but also contain DNA. The latter mitochondrial DNA is only passed down from a mother to all her children and is also called maternal DNA. The father on the other hand, passes the Y-chromosomes to all his sons. This type of DNA, mitochrondial and Y chromosome, is also called "Adam and Eve" DNA respectively and has been most useful, in tracing population migration.

The DNA patterns that are found in the different parts of the world are all present in Africa. No other part of the world contains all the different patterns which suggests a "founding population in Africa" and has been referred to as 'The Out of Africa Theory of Evolution'.[8 9]

The theories above make a logical argument for the evolution of skin colour and are also likely to explain hair colour. However, the reasons for the evolution of hair form are less clear. Tightly curly hair is common in Africa, which could lead to the hypothesis that hair curl was an advantage for the local environment. Yet the Indian subcontinent which has a similar climate has inhabitants with predominantly straight hair. Further study is likely give rise to interesting explanatory theories for hair form as has been the case for skin colour. For example, dark skin

in very cold climates such as the Inuit in Canada where it is suggested that traditional diet rich in Vitamin D[7,10] may have opposed need for UV dependant Vitamin D synthesis in the skin, and thus the evolution toward a fairer skin colour.

Hair form and the definition of "African" Hair

The phenotypic variation in human hair has stimulated much research. In spite of differences in the distribution of high and low sulphur proteins, the biochemical composition of hair in people of different geographic origins has been shown to be surprisingly similar with regard to keratins and amino acid content.[11-14] The latter is in spite of significant difference in both appearance and behaviour (e.g. combability, elasticity etc) as comprehensively reviewed by Wolfram[15] and Franbourg *et al*.[16]

Differences in hair form of people from different parts of the world have also stimulated attempts to classify hair form into types. These include straight, wavy, frizzy and woolly,[17] straight, wavy, kinky and woolly,[18] and straight, wavy and helical.[19] In older textbooks hair forms were divided into three large groups: straight hair of Mongoloid type, spiral hair of Negroid type and that of Caucacians which is thought to vary between the two. The terms Negroid and Mongoloid have become less acceptable, while Caucasoid refers to a very large area which includes parts of Europe and the Indian subcontinent and is thus non specific. There is a view that simple division of humans into three categories is no longer acceptable without debate (Littlefield et al 1982) 'as these categories tend to lump highly variable populations and ignore the reality of human variation.'

In an attempt to quantify these differences between hair form, one of the early measurements performed by physical anthropologists in the 19th century was a calculation referred to as trichography (as quoted in M'buntu 2001). This was based on dividing the longest by the shortest diameter of the cross section of hair (as measured by a trichometer). The highest possible score was 1, the more round the cross section of the hair, the closer the score would be to 1. Hair with an ellipse cross section usually scored below 0.60 (around 0.55). Interestingly these distinctions were soon used for racial classification; for example, a score of below 0.60 was classified Negroid and hair with an almost round cross section would score close to 1 as Mongoloid. This measurement has been largely abandoned and in fact the term 'trichogram'

now refers to hair growth studies [20]. In the latter studies an area of scalp hair 1 cm in diameter is shaved flush with skin and measures of hair growth are taken at specified intervals using specified techniques, to look at the different phases of hair growth or to study the rate of hair growth with treatment.

Attempts have also been made to classify hair form into a larger number of more specific groups. Probably the most exhaustive study done after the observation that cross section alone was not enough to determine hair form or that 'the curliest hairs do not necessarily have the most elliptical cross section' was performed by Hrdy.[21] This study examined hair from seven populations: Aita - a non-Austronesian-speaking tribe from Bougainville Island; Baegu – a Malaysian speaking coastal tribe; East African group - Kampala Nairobi, Beira Mozambique and Lusaka Zambia; The Northwest European - students at Harvard; Sioux – from a collection in the Peabody Museum; Ifugao Philippines - from a collection in the Peabody Museum and Japanese - workers at Massachusetts General Hospital and students at Harvard.

This study included population samples drawn from 30 individuals with 40 individual samples from each group, and examined 8 parameters:

1. Diameter.
2. Medullation - present, discontinuous or absent of the inner layer of the hair.
3. Scale count - the number of the cuticular scales on a straight line per given distance, in this case 0.52mm.
4. Kinking - sudden constriction and twisting of hair shaft, producing an obvious discontinuity in curvature. Each hair was scored as zero= no kink and 1=kink.
5. Average curvature – each hair was placed between two glass slides, allowing measurement of curvature of hair that varies in three dimensions.
6. Ratio of maximum to minimum – those curls of hair that have the highest and lowest curvatures. A hair that has curves of similar size (regular hair) and one that has a single curve will both have a ratio approaching one, whereas irregular hair (small and large curves) will have a high ratio.
7. Crimp – the number of times the direction of curvature changes per unit length.
8. Ratio of natural to straight length – a measure of the effect of curling on length,

comparing the natural curled length and the length when the hair is held straight using a forceps.

The results showed participants of Asian ancestry (Philippines, Japanese) to have the largest diameter and most consistent presence of the medulla. The East African hair (Nairobi, Mozambique, Zambia) had the highest kinking, curvature, crimp and ratio of natural to straight hair.[21]

In spite of attempts to classify hair forms into more groups, in recent years, possibly partly for convenience, the classification currently used in dermatology literature has gone back to that of the three major groups, which classify human hair as: African, Asian and European. This classification, however, still largely depends on the hair cross section. Hair curl has been shown more conclusively, using computer aided three dimensional reconstruction of scalp biopsy cross sections,[22] to correlate with the shape of the follicle (curly/spiral in African hair, straight and perpendicular to the skin in Asians) and not the cross section as previously thought. This study found that hair with different cross section shapes may occur in the same person and people with similar hair cross sections may have different amount of hair curl.[22] The latter was an elaborate study that showed not only that "Europeans" had a follicle shape that was a variation between that of "Africans" and "Asians" but also that even a straight follicle may produce a hair shaft that has an oval cross section. The findings of this latter study have been recently confirmed by Thibaut *et al* who showed that the shape of the hair is programmed from the bulb and is independent of the connective tissue.[23] They did this by dissecting hair follicles out and growing the hair in vivo, and using immunohistochemistry demonstrated asymmetric differentiation of various layers of the bulb which results in the curved hair follicle that is typical of "African" hair.[23]

The term 'African hair' is not made easier by the 'Out of Africa' Theory which suggests that all humans are African, at least in origin. Even though not ideal, we can take comfort in that the most significant findings to date; whether using characteristics of hair form,[21] computer aided reconstruction of scalp follicles[22] or immunohistochemistry of the bulb[23] have been that 'African' and 'Asian' follicles represent extremes of the spectrum of hair morphology. The latter, also possibly explains the poor uptake of classifications with multiple groups and a pragmatic

classification of hair into three major groups: African, Asian and European which is currently used in major dermatology texts. This pragmatic classification, ideally, should not be used without definition in scientific manuscripts because even the hair phenotype of indigenous Africans in Africa varies. This becomes even more complicated when one considers African American and Afro Caribbean hair because of increased heterogeneity.

Creative definitions of African hair should, ideally, stay true to established data[21-23] and evolve as new evidence becomes available. If it were not for hair disorders that are specific to this hair type, attempts to clarify terminology would be unnecessary. The current racial classification of hair is not ideal. Race is not a quantifiable biologic entity and there is more variation within than between groups; yet its social effects are not insignificant.[24] However race is in fact only a proxy; it is a useful, albeit nonspecific, surrogate for hair form and its use suggest a lack of scientific rigor in current terminology. The need for an objective, validated, classification of hair form that is independent of race is long overdue.[25]

For the purpose of this thesis African hair is tightly curled black hair typical of sub Saharan Africans. Although no biopsies or histology examination will be performed in our subjects, their hair would be expected to emerge at an angle from 'curled or spiral hair follicles,' and to have ellipse cross section.

African hair growth and behaviour (response to grooming)

The hair follicle goes through a cycle of active growth (called the anagen phase which lasts 3 – 8 years), regression of the lower half (called the telogen phase, which lasts a few weeks) and a period of rest (called catogen phase lasting 2-3 months) before the hair is released and shed from the hair follicle. At the end of telogen the entire cycle begins again. Standard dermatology texts indicate that hair grows an average of 1cm a month. A recent study has suggested that African hair grows slower than that of Europeans [mean (SD): 256 (44) vs. 396 (55)] micrometers per day respectively.[26] However, a chance for potential bias exists in the latter study because historic European data was used for comparison, i.e. growth parameters were not measured at the same time in all the groups.

African hair has unique responses to normal everyday grooming such as combing.[15,27,28] The most significant seems to be a "failure" of natural hair to be significantly long. The latter has

been shown to be related to significant breakage during combing, which eventually results in a "steady state" and persistently short combed hair even many years without a hair cut.[29] It is thus likely that some of the physical and chemical grooming practices that are now prevalent and uniquely performed on African hair are in response to perceived problems with the behaviour of natural African hair such difficulty in combing, slower growth rate and fragility which is more likely to be mechanical rather than inherent.[28,30]

Hair fashions are many and varied and are influenced by many factors. A discussion on slavery, colonialism, racial superiority and their influence on a racial notion of appearance (specifically a desire for long straight hair) is not the subject of this thesis. However their effect on our history and current behaviour cannot be ignored.

In Apartheid South Africa, one's hair type could determine where you could live, whether or nor you got a job i.e. social status. Racial classification was based on physical appearance which included skin colour, the shape of the nose, hair texture and colour. At times the decision would depend on the hair. Black hair that was straighter and smoother was classified as 'Coloured' which afforded better opportunities than if classified 'Black or Native.' The method used for such classification in 'unclear cases' was rather crude, and became known as the 'pencil test.'[31] This involved an officer inserting a pen into the applicant's hair. Unverified reports claim that the applicant would be asked to shake their head. If the pen fell off, they were Coloured and if not they were classified African. The preference for long straight silky hair (which was not unique to South Africa) is likely to have influenced the development and or the uptake of chemicals used for straightening hair.

The pain associated with combing natural African hair makes the long history of attempting to make African hair easier to comb, also understandable. More recently it is likely that the pressure from advertisers, fashion and contact with other cultures have contributed, in varying degrees to the preference for chemically straightened hair that is now prevalent (80% African women, according to unpublished hair industry data). Although political pressures may have influenced the older African generation, it is less likely to be the case for younger Africans who seem more influenced by fashion trends. In South Africa since independence natural hairstyles braids, dreadlocks, twist, cornrows etc. have become very popular, but the

chemical altering of both hair colour and texture is also prevalent.

It is also interesting to see how many young people change from natural to chemically altered hair and back to natural hairstyles, suggesting that it is more about 'the look.' That even if it is about 'making a statement' it is certainly not a political one (e.g. black consciousness ideology, associated with slain South African freedom fighter Steve Bantu Biko. This was popular in the 1970's and promoted slogans such as 'black and proud' and 'black man you are on your own.'[32]

As Africa is the cradle of mankind, it is likely that hair care on this continent has been going on since the beginning of human existence. Unfortunately, partly because of the oral tradition of passing down history, it is difficult to find documented evidence of the history of hair care. It is likely that many original African communities molded hair into shapes using various clays and used special head dress and masks, kept their hair cut short, or did braids and plaits – individual blocks or corn rows (with or without extensions from e.g. special grasses, fibers etc).

Hair styles, bead work, traditional dress and house hold implements are beautifully illustrated in books.[33,34] The choice of hairstyle depended on the tribe and on the person's station in life, for example among the Zulus married women would often have different hairstyles from young maidens.[33] Although small comb like structures have been uncovered with archeological finds, it is not clear if original Africans combed their hair or if these implements were purely decorative. Although not written down, fascinating stories of more recent hair care (and hair disasters) are often told by older family members and friends, from straightening hair with hot stones and combs, to plastering it close to the scalp with pomades etc. This part of South African history has unfortunately not yet been the subject of systematic research.

The documentation of inventions by patent registries is a useful source of hair care historic data.[35] Heat (hot combs, curling irons, etc.) was apparently first used in Paris to straighten curly hair or to curl straight European hair. The first hot comb for straightening African American hair was patented by Walter Sammons in 1920. Solomon Harper later patented the thermostatic curler in 1930. Before the advent of hot combs however, Lydia Newman in New York designed a new and improved brush that 'provided ventilation during brushing by having recessed air

chambers'. This brush was patented on November 15, 1898.[35]

An outstanding pioneer is Madame C.J. Walker (1867 -1919), a descendant of slaves who became one of the very earliest 'rags to riches stories' in America by selling hair products. She apparently said this of herself "I am a woman who came from the cotton fields of the South. From there I was promoted to the washtub. From there I was promoted to the cook kitchen. And from there I promoted myself into the business of manufacturing hair goods and preparations. I have built my own factory on my own ground" and "I got my start by giving myself a start." Hers was apparently not a chemical hair straightener but a "Wonderful Hair Grower."[36]

The person credited with manufacturing the very first chemical straightening cream is the inventor Garrett Morgan. He initially worked as a sewing machine technician. While testing different oils to reduce friction in his needles, he apparently wiped his hands on a piece of fleece; noting the change in texture later repeated the experiment on a neighbor's dog. The dog's hair apparently changed to such an extent that "the owner not recognizing it chased the poor animal away."[37]

In the last two decades two local pioneers in the African hair industry stand out. Herman Mashaba started manufacturing hair relaxers in his garage, and this has now grown into a popular brand of 'Black Like Me' Hair products.[38] The second, the founder of probably the most easily recognizable local brand for Natural African Hair (i.e. chemically unaltered hair and dread locks) in this country, is Jabu Stone.[39] Mashaba and Stone are currently establishing their brands in the United Kingdom and the United States of America respectively.

The multiple billion dollar international hair industry produces and sells products used for daily grooming (e.g. shampoos, conditioners) and those used intermittently. The latter are chemicals that alter hair colour or structure (e.g. hair dyes, permanent wave and the so-called 'relaxers' used for African type hair). African-Americans spend an estimated $325 million on hair care per year. In Brazil the black hair care market is valued at over two billion dollars. In Britain, 70 percent of beauty expenditure in the "ethnic" category, or some $50 million, is on hair care. South African women spend approximately $130 million annually on their hair. The power of advertising on current trends and vice versa cannot be underestimated and there is now a very wide variety of hairstyles that are performed on African hair.[40]

Hairstyles are not without side effects and as dermatologists, we are interested in

the effects of hair grooming on hair and scalp health. Various case reports and case series have reported the possible association between hair and scalp disorders and the use of hair products.[41,42] However, individual case reports are not appropriate for estimate how common complications of hair dressing are in the community. Population studies are more reliable in estimating measures of disease occurrence such as prevalence (or incidence) and the strength of association between a disease and an exposure.

Hair / Scalp Disorders [43]

Hair and scalp disorders may be broadly classified into: primary or secondary.

Primary scalp disorders include the major disease groups:

- Infective (the commonest infections are bacterial – streptococcal and staphylococcal, syphilis, and fungal – dermatophyte infections)
- Infestations – the commonest of which is head lice infestation.
- Inflammatory (eczemas, psoriasis, lichen planus variants, lupus and other autoimmune conditions such as pemphigus variants, and the less common scarring folliculitides such as folliculitis decalvans, genetic ones such as the variants of Keratosis Pilaris Atrophicans).
- Auto immune, the commonest diseases that affect the scalp are alopecia areata with its variants, and Lupus erythematosis (the acute form results in diffuse hair loss and the chronic form in scarring alopecia)
- Neoplastic (benign and malignant tumours can lead to primary hair loss and also secondary to their treatment with chemotherapy, radiation etc)
- Other causes e.g. androgenic alopecia, the commonest cause of non scarring hair loss, is thought to occur as a result of increased end organ sensitivity to androgens and not necessarily due to increased circulating androgens (although a subset of patients falls in this group). Genetic factors are also thought to play a role resulting in various hereditary diseases which may present with hair loss associated with or without other manifestations.

Secondary scalp disorders include those that occur as a result of complications of hair treatments

(such as chemical burns, allergies, secondary infection) and complication of other primary disorders e. g. secondary infections and scarring (complicating primary inflammatory disorders such as eczema, auto immune condition etc as listed above).

Primary hair disorders mainly involve genetic hair shaft abnormalities e.g. Netherton's Syndrome (Atopic tendency with 'bamboo shaped hair', Menkes Kinky Hair (genetic copper deficiency with abnormal hair), Trichothiodystrophy (please see introduction), to name but a few.

Secondary hair disorders mainly involve cosmetic damage (such as over processing, bleaching and dyes). The change in the texture (and even the colour) however may also occur as a result of systemic diseases and nutritional disorders especially deficiencies (protein-calorie, various vitamins and trace elements such as zinc and copper). Mechanical manipulation and habitual pulling of hair that is thought to occur in psychological pathologic states may result in bizarre patterns of hair loss.

Anecdotal case reports have suggested that the scalp disorders of interest in this thesis may be associated with hair dressing. These are traction alopecia (TA), Central Centrifugal Circatricial Alopecia and Acne Keloidalis Nuchae (AKN). How much hairdressing or inherent features such as the unique shape of African follicles contributes to disease pathogenesis remains unclear.

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Chapter 2

How common are African hair specific adverse effects of hair dressing? A systematic literature review

Setting the stage

African hair has a unique shape and for various reasons such us fashion and politics, as mentioned previously, various methods are used for hair dressing. The latter is generally different between the genders, e.g. chemical relaxers and braids are more common in females, and short haircuts are more popular with males. People of African ancestry seem to have a higher prevalence of specific scalp disorders, which are suspected to have an association with hair dressing. These are Traction alopecia (TA), Central Centrifugal Circatricial Alopecia (CCCA) and Acne Keloidalis Nuchae (AKN). It is not clear to what extent adverse effects from grooming or the unique shape of the follicle contribute to the development of specific scalp disorders.

Although TA can affect any population group people of African decent have dominated published reports and this has been assumed to be because of the popularity of braids, weaves, hair extensions, and tight ponytails in this population.1-5

CCCA, was initially referred to as 'hot comb alopecia' and later as Follicular Degeneration Syndrome (FDS).6 Initially, the heat associated with the use of the hot comb for straightening hair was suspected as the cause. Later, cases in people who had never used the hot comb were described and 'premature degeneration of the inner root sheath' of the hair follicle was identified in biopsies of affected scalps. These findings were inconsistent and the name CCCA is now preferred.7 CCCA occurs almost exclusively in African women, who tend to have specific hair grooming practices and is reported rarely in men.8 This condition may occur as a result of hair dressing procedures such as the use of chemicals,9 but traction may also play a role.

AKN is a scarring alopecia predominantly affecting African men with a predilection for the nuchal scalp. Lesions start as papules and pustules and heal with small or large confluent keloids. The pathogenesis of AKN is unclear but there is suspicion that hair grooming, particularly shaving very close to skin and friction, may play a part in susceptible individuals. The role of bacteria is still unclear.10

The most important aim of this thesis is to quantify the prevalence of specific hair and scalp disorders, which based on anecdotal data, appear to be more common in people of African ancestry. The second is to assess whether there is any evidence of an association between hairstyle choice and disease.

This section covers a comprehensive review of the literature, and uses evidence based methods of 'systematic review' as used by The UK Cochrane Collaboration, Skin Group (based in Nottingham, United Kingdom). The advantage of this method is that it follows a clearly defined sequence of steps that is not only likely to identify most studies but can also be repeated at a future date. Although the most extensive use of the latter systematic review method has been for summarizing evidence of the effectiveness of therapeutic interventions (i.e. randomized controlled trials), it has been modified previously to summarize observation studies11 and will be used here, specifically for prevalence studies.

Aims

The aims of this systematic review were:

To establish the prevalence or incidence of specific hair/scalp disorders that are suspected of having an association with grooming, and are thought to be more common in Africans, CCCA, AKN and TA.

Methods

Search strategy

Literature searches of three versions of Medline (Silver Platter, Ovid and Pubmed) from 1966 to Dec 2004, with a repeat search in August 2005 were performed. The references of relevant manuscripts were also examined for more studies.

The search performed used the following search (including synonyms of common) terms:

African hair OR African American hair OR Afro Caribbean hair OR traction alopecia OR trauma alopecia OR hot comb alopecia OR follicular degeneration OR central centrifugal alopecia OR acne keloid OR acne keloidalis OR folliculitis keloidalis OR dermatitis papillaris capillitii AND survey OR cross sectional study OR prevalence study OR cohort study OR incidence study OR

population study.

All abstracts identified by the searches were studied and the relevant ones were selected and the full manuscript studies both to see if it fulfilled the inclusion criterion and also if any of the references listed studies that might be appropriate for inclusion.

Inclusion criteria

We limited inclusion to the following observational studies: cross sectional (prevalence) and cohort (incidence) studies of cutaneous complications associated with hair grooming practices seem more common in Africans. These study designs were chosen because they could give a measure of disease occurrence. All studies with appropriate designs were included.

Exclusion criteria

Case reports, case series, case control, and interventional studies were excluded as the design of these studies can not give estimates of the prevalence or incidence of disease.

Quality Assessment

The quality of studies was assessed using criteria developed by Radulescu et al for prevalence studies.11 These include 7 major criteria:

1. Was the population specified?
2. Was the sampling method specified? (Random sampling ideal).
3. Was the sample size adequate? (Whole population ideal but usually not possible. The larger the sample size, with narrow confidence interval, the better the estimate).
4. Was the response rate adequate (at least 70%)?
5. Was information given on non responders?
6. Was a valid and repeatable disease definition given?
7. Have reasonable efforts been made to reduce observer bias?

   We included an 8th criterion, an estimate of the number of participants lost to follow up, to cater for cohort studies.
8. Was the loss to follow up acceptable (less than 20%)?

We graded the studies on each criteria Y= Yes or N= No if the question clearly is or not satisfactorily

answered and ?= for unclear or missing information.

Results

The search identified 121 articles of which only 3 studies fulfilled the inclusion criterion.12-14 Because of the small number of studies identified, an additional search which excluded combining the search terms with the study designs was performed. This latter search identified 520 references; however there were no additional prevalence or cohort studies, the minimum requirement for fulfilling the inclusion criteria.

Quality of included studies

Of the seven criteria for quality assessment only one study satisfied five criteria,14 three satisfied three12 and two studies satisfied two.13 All the studies were cross sectional in design. The details of all the studies including their quality assessments are summarized (Table 2.1).

Only three studies could be found which examined two of the three conditions among Africans that may be associated with hair styling. A prevalence of AKN among patients in a Nigerian skin clinic was 1.3%.14 Interestingly this study found that bacteria, especially S. pyogenes, was cultured from the skin in 95% of affected cases.14 Nuchal Acne Mechanica, which is thought to be induced by friction from the helmets, was more prevalent in high school players (15.5%) than older professional players (1.2%). Among the older players, there was a prevalence of AKN of 13.6% vs. 0% in African and Whites respectively.12 Among adult male patients in a London skin clinic, the prevalence of AKN, which included scalp folliculitis, was 13.7%. TA had a prevalence of 1% among adult patients.13

No studies estimating the frequency of CCCA were identified.

Discussion

The conditions affecting African hair which are possibly related to hair grooming have a prevalence ranging from 1.3% to 13.7% for AKN and 1% for TA. All the studies were performed in clinical settings in Europe and America with only one African study. None of the studies were performed in the general population and no study reported the frequency of occurrence of

CCCA.

Important findings of this study are:

1. Although case reports suggest that AKN, TA and CCCA are more common among Africans than other groups, only three prevalence studies have been published and none have been in the general population. No studies looking at CCCA in any population have been identified. An association of these conditions with hair dressing preferences between males and females is posible, although it is still not clear how much the curved African hair follicle contributes to their pathogenesis.15

Study limitations

Limitations of this review are the restriction of the literature search to Medline and inclusion of observational studies. Searches of other electronic data bases, publication in other languages, hand searches from journals and industry sources could have identified more studies although the latter are more likely to be case reports. Observational studies are prone to bias such as the choice of the sampling frame and selection bias which is influenced by the diagnostic criteria.

Conclusions

The most important finding of this review is the demonstration of the lack of data for the prevalence of conditions specific to African hair, only 3 special group studies (clinic and footballers) none including general populations were identified. The next chapter attempts to fill this void; it is studies of hair style preference and the prevalence of AKN, TA and CCCA in school children and adults.

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Table 2.1 Scalp conditions common in African hair

Study	Place	Study design	Measurement	Subjects	Main outcomes	Quality and comment
George et al. 1993 [54]	Nigeria	Cross sectional study	Clinical examination	Skin Clinic, details of sample not stated	Acne keloidalis (AK) accounts for 1.3% of patients with skin conditions	1=Y, 2=Y 3=Y 4=Y 5=N, 6=N, 7=?
Knable et al. 1997 [52]	USA	Cross Sectional Study	Clinical examination	453 high school, college, and professional football players	AKN prevalence 13.6% vs. 0% in African vs. Whites AKN commoner in older players & found exclusively in blacks.	1=Y, 2=Y 3=? 4=?, 5=N, 6=Y, 7=?
Child et al. 1999 [53]	London	Cross sectional study	Clinical exam January – March 1996	461 consecutive black patients Skin clinic	AKN (and scalp folliculitis) = 13.7% of TA = 1% Both diagnosed in adult patients	1=Y, 2=Y, 3=? 4=? 5=N, 6=N, 7=?

Quality refers to 1= was the population specified, 2=was the sampling method specified? 3= was the sample size adequate, 4= was the response rate adequate (atleast70%)? 5= was information given on non responders? 6= was a valid and repeatable disease definition (or exposure where exploring potential adverse effects) given? 7=have reasonable efforts been made to reduce observer bias?

Y= YES, N= No, and ? = not reported

Chapter 3

Hairdressing and the prevalence of scalp disease in African school children

Chapter abstract

Background Anecdotal reports suggest that certain disorders are common in African hair and may be associated with hairstyles. This cross sectional study of 1042 pupils was performed to test this hypothesis.

Methods A questionnaire was administered and scalp examinations performed, after ethics approval.

Results Participants included 45% boys and 55% girls. The majority of boys, 72.7%, kept natural hair with frequent haircuts (within 4 weeks). The prevalence of acne (folliculitis) keloidalis nuchae (AKN) was 0.67% in the whole group and highest (4.7%), in boys in the final year of high school all of whom had frequent haircuts ($p<0.02$). The majority of girls (78%) had chemically relaxed hair, which is usually combed back or tied in ponytails, vs. 8.6% in boys ($p<0.0001$). Traction alopecia (TA) was significantly more common with relaxed than natural hair ($p<0.0001$), with an overall prevalence of 9.4% (98/1042); 17.1% in girls, in whom it increased with age from 8.6% in the first year of school, to 21.7% in last year of high school. The proportion with TA in participants with a history of braids on natural hair was lower (22.9%), but not significantly, than among those with a history of braids on relaxed hair (32.1%). No cases of central centrifugal cicatricial alopecia were identified.

Conclusions We found associations between hairstyle and disease in schoolchildren. AKN appears to be associated with frequently cut natural hair and TA with relaxed hair. These associations need further study for purposes of disease prevention.

Introduction

For the purpose of this article, African hair is defined as tightly curly (spiral) black hair typical of sub-Saharan Africans. In South Africa, although natural (chemically unaltered) hair styles such as twists, coils and dread locks are becoming more popular, chemical straighteners or relaxers

are commonly used by females (80% of age group 15 – 50 years; personal communication cosmetic company in-house study).

Chemical hair relaxers are used on African hair and contain alkaline chemicals such as sodium hydroxide and guanidine hydroxide.[1] Girls tend to use relaxers for length; the hair is usually combed back and/or tied in a ponytail to which artificial extensions may be attached (Figure 3.1). Hair braiding of virgin or chemically treated hair, with or without hair extensions, is also popular. The same chemicals used as relaxers are occasionally applied to the hair for shorter periods (<10 vs. 15 – 30 minutes) than when relaxing, so as to produce a loose curl (wavy) effect popular with some boys called 'the s-curl' if the hair is kept short (Figure 3.2) or a 'blow out' - if allowed to grow longer. The latter allows a larger afro than usually possible which popular with some girls. Relaxed hair in this study is inclusive of all above groups. Some of these hairstyles may result in complications such as chemical burns, allergic reactions, and hair loss.[2-4]

Anecdotal reports suggest that certain scalp disorders, which may be associated with hair dressing, are more common in individuals of African descent, acne (folliculitis) keloidalis nuchae (AKN)[4] - a scarring alopecia that has a predilection for, but is not limited to, the nuchal scalp; central centrifugal cicatricial alopecia (CCCA)[4] – previously called 'hot comb alopecia' and 'follicular degeneration syndrome' and traction alopecia (TA).[4,5] We performed a systematic review of the evidence for this and found a paucity of population studies on these conditions (Chapter 2). We were also unable to identify studies that report hair style trends and possible association with scalp (and hair) disease in Africans. However a subsequent Nigerian study has suggested an association between frequent hair relaxer use and scarring alopecia.[6] Although TA and CCCA are usually seen in adult females and AKN in adult males it is not certain what their age of onset is.

Objectives

There were three primary objectives of this study:

1. To determine the prevalence of various hairstyles in African children attending school in Langa Township in Cape Town.

2. To determine the prevalence of specific scalp/hair disorders (TA, AKN, CCCA) and the variation with age and gender.
3. To describe possible associations between scalp disorders and hairstyle.

Methods

1. Pilot Study

In view of the previously mentioned lack of data a pilot study which included all age groups was conducted at a primary health care centre in Cape Town in order to get estimates to use for sample size calculation for at least some of the conditions. The study included all ages. Consent was received from the relevant administrators and the participants. Clinical examination of the participant's scalp was performed by a dermatologist and the following data were collected: age, gender, current hair style and clinical diagnosis of pathology (if any). All 104 people that were asked agreed to participate in the study: 80 females and 24 males, average age 27.9 years (range 1 – 78). No participants were found to have CCCA. The prevalence of TA in females was 39% (37 out of 80) vs. 0% in males, and of AKN 8% in males (2 out of 24) vs. 0% in females. No other disorders were diagnosed.

2. *Main Study*

Ethical approval was received from our institution's Research Ethics Committee and permission was granted by the Western Cape Provincial Government's Ministry of Education. Informed consent was obtained from parents or from participants if older than 18 years.

The study design was a cross-sectional survey. Participants were in their first and last years in two primary and two high schools in Langa Township in Cape Town (randomly selected out of six primary and four high schools respectively). A sample of 352 females was required to obtain a 95% confidence interval of +/- 5% around a prevalence estimate of 39% for TA. Similarly a sample of 706 males was required to obtain a 95% confidence interval of +/- 2% around a prevalence estimate of 8% for AKN, based on the pilot study. The plan was to look for the disorders of interest (AKN/TA/CCCA) and document any other clinical diagnoses of scalp disorders, in all participants irrespective of gender. However, during consultation with the principals it became apparent that examining different numbers of girls and boys would

prove too disruptive. A decision was thus taken to examine all consenting pupils in each of the chosen grades irrespective of gender, and a total of 1060 pupils were invited to participate.

A previously piloted questionnaire was administered by a trained assistant and included demographic data as well as questions on grooming methods, reasons for the choice of hairstyle and current and past hair styles (Annexure at end of chapter). All subjects were examined by the same dermatologist to record the current hairstyle and the condition of the scalp. Digital photography was used to record interesting hair styles and disease findings. Statistical analyses were performed using STATA version 9.0 (STATA Corporation, College Station, TX). Prevalence figures were calculated as percentages and associations were compared using the Fisher's exact test and Chi-squared test. All significance tests were two-tailed and significance was defined at the 5% alpha level.

Results

Of 1060 invited scholars, consent was received from 1042 (age range 6 – 21 years). There were 2 refusals and 16 were not at school on study days. Participants included 45% (467) boys and 55% (574) girls (Table 3.1). Children in the first year of school were not asked to fill in the questionnaire because of their age (6 year olds = 177) and this accounts for most of the difference in totals of the results in this study.

On examination, natural hair was more common in boys than girls [88.7% (407/459) vs. 27.3% (120/560)]. A much higher proportion of boys than girls had frequent haircuts (within 4 weeks) [72.8% (268/368) vs. 13.5% (65/480), $p<0.0001$]. In contrast, a greater proportion of girls than boys recorded their hair as relaxed [78% (382/487) vs. 8.6% (31/362), $p<0.0001$]. This difference was similar to that found on examination of the whole group [72.5% (407/560) vs. 11.3% (52/459,: $p<0.0001$]. (The latter difference is partly explained by the fact that the examination included the previously mentioned 6 year olds).

The prevalence of acne keloidalis nuchae (AKN) in the whole group was 0.67% (7/1042), all in boys (1.49%, 7/466). In high school boys the prevalence was 2.2% (7/321) and was highest (4.7%, 6/129) in boys in the last year of high school. Disease severity in all affected AKN participants was mild (Figure 3.3). There was a significant association, in all participants with natural hair, between AKN and frequently cut hair (hair cut < 4weeks) vs. participants with hair

cuts > 4weeks (7/261 vs. 0/199: p = 0.02).

In girls most relaxed hair was worn in a 'push back style' or ponytail whereas in boys it was kept short. Heat (hairdryers, tongs, etc.) was not used daily/weekly by any participants; but rather rarely on special occasions e.g. weddings. In addition, no participants use hot combs.

The prevalence of TA was 9.4% (98/1042) in all participants; 17.07% in girls, among whom it increased with age from 8.6% in the first to 21.7% in the last year of school (Figure 3.4) (Table 3.2). There was a larger proportion of participants with relaxed hair who had TA than those with natural hair (90/463 vs. 8/556: p< 0.0001), a finding that was maintained when the analysis was limited to girls (90/407 with relaxed vs. 8/152 with natural hair, p< 0.0001).

Although braids and extensions were not allowed with school uniform, these were worn during weekends and school holidays. The history of previous hairstyles included braids on natural hair, braids on relaxed hair and hair worn as dreadlocks. The prevalence of TA in the latter groups of participants respectively was 19% (39/205), 30.3% (27/89) and 0% (0/14) in all participants, and 22.9% (39/170), 32.1% 27/84 and 0% (0/5) in girls.

Although the proportion of TA with a history of braids on natural hair in girls was lower than that with braids on relaxed hair, the difference was not significant (p=0.116). There was a significant difference in the prevalence of TA between girls with natural hair and that among girls with a history of braids on natural hair [5.2% (8/153) vs. 22.9% (39/170), p<0.0001], suggesting that a history of braids on natural hair may increased the prevalence of TA. However, this difference is confounded by currently relaxed hair in the majority of these participants (36/170). No cases of CCCA were identified.

Discussion

Neither TA nor AKN have previously been reported in general or school population studies (Chapter 2). We found a significantly higher disease occurrence of TA than that reported in clinic based studies (1%) in London[7] and recently (7.7% of 39 women) from Nigeria,[6] and closer to that reported among adult female African volunteers (33%) in an industry study.[8] In this study the prevalence of TA was significantly higher in girls with relaxed hair than in those with natural hair.

The high prevalence of TA in relaxed hair, which is mostly combed back and worn in

ponytails, is consistent with the hypothesis that traction is causal. However the extent of the contribution of chemical relaxers to increased hair fragility remains uncertain. It has been suggested that relaxers 'weaken the hair structure'[14] and increase fibre fragility.[15] Thus relaxed hair may be less resistant to traction, predisposing it to a higher risk of developing TA.

Although school rules forbade our participants from wearing braids, these were worn on weekends and during holidays. The prevalence of TA was higher, although not significantly, in participants with a past history of braids on relaxed hair than on natural hair. The additional traction from intermittent braids is likely to have contributed to the prevalence of TA in our population. Adult studies that include participants with braids as usual hair styles are likely give more accurate estimates of TA in braids.

The prevalence of AKN in our population was similar to the case frequency (1.3%)[9] reported among patients in a Nigerian skin clinic, and lower than 13.7%, which included scalp folliculitis, reported from a London skin clinic. It was also lower than that reported among American football players who all wear helmets, of 13.6% vs. 0% in blacks and whites respectively.[10] In the latter study the prevalence in high school vs. older players was 5.2% (8.1% in blacks, 0% in whites) vs. 9.4% (16.1% in blacks, 0% in whites). The prevalence in high school players in the latter study is closer to that in our population of boys in the last year of school (4.7%).

Of the three conditions (TA, AKN, CCCA) thought to be common in Africans and to have an association with hairstyle choice, we previously failed to identify any studies estimating the frequency of CCCA in any population (Chapter 2). The recent Nigerian clinic study[6] reported CCCA in 15.4% of 39 adult females presenting with hair loss and found an association between prolonged and frequent use of relaxers (23.2+/-9.3 years) and 'scarred alopecia.' We did not identify a single participant with alopecia consistent with CCCA.

This study has found an association between hair style choice and the prevalence of specific scalp disorders. TA is common in girls, increases with age and is significantly associated with relaxed hair. The effect of a history of braids on disease prevalence is difficult to interpret. AKN is more common in older boys who have frequent haircuts. Studies among adults, who have a wider hair style choice and have manipulated their hair for longer, are likely to yield more information about the association between hair grooming and disease. Estimation of

the contribution of individual variables to disease development will help in the formulation of effective preventive and treatment strategies.

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Figure 3.1

Relaxed hair tied into a ponytail to which an additional straight or curly extension can be attached to increase volume.

Figure 3.2

The 's-curl' - a loose curl (wavy) effect, prominent when hair is kept short, is produced by applying the same chemicals used as relaxers for much shorter periods than when relaxing. When the hair is allowed to grow longer the same procedure produces an effect called the 'blow out' allowing a larger afro than usually possible.

Figure 3.3

High school boy with acne (folliculitis) keloidalis – typically mild in this age group

Figure 3.4

Young girl in grade 1 class with relaxed hair, demonstrating prominent traction alopecia

Table 3.1 Characteristics of study population

Characteristic	N (%)*			P-value
	Total	Girls	Boys	
Age group (years)				
< 10	176 (17.6)	81 (14.6)	95 (21.2)	
10-15	215 (21.5)	126 (22.7)	89 (20.0)	
> 15	610 (60.9)	347 (62.6)	263 (58.8)	
Total	1001	554	447	0.021[a]
Hairstyle on examination				
Natural	560 (54.9)	153 (27.3)	407 (88.7)	
Relax	459 (45)	407 (72.5)	52 (11.3)	
Other	1 (0.1)	1 (0.2)	0 (0.0)	
Total	1020	561	459	<0.0001 [a]
History of braids				
Braids (Natural hair)	205 (66.6)	170 (65.6)	35 (71.4)	
Braids (Relaxed hair)	89 (28.9)	84 (32.4)	5 (10.2)	
Dreadlocks	14 (45.5)	5 (2.0)	9 (18.4)	
Total	308	259	49	<0.0001 [a]

Denominators differ due to missing values.

[a] p-value based on Chi-squared test of association for difference between boys and girls.

Table 3.2 Variation in the prevalence of Traction Alopecia (TA) in girls

	N (% with TA)
Total	574 (17.07)
School level	
First year of school	81 (8.6)
Last year primary & first year high school	258 (15.6)
Last year of high school	235 (21.7)
Hair style on examination	
Natural hair	153 (5.2)
Relaxed hair	407 (22.11)
Hairstyles on history	
Braids on natural hair	170 (22.9)
Braids on relaxed hair	84 (32.1)

Chapter 4

Hairdressing and the prevalence of scalp disease in African adults

Chapter abstract

Background Anecdotal reports suggest that certain disorders are common in Africans and may be associated with hairstyles. This study of 874 African adults in Cape Town was performed to test this hypothesis.

Methods A questionnaire was administered and scalp examinations performed, after ethics approval.

Results Participants included 30.9% males and 69.1% females [median age 36.1, range 18 to 99]. Most males had natural hair 91.7% vs. 24.3% females. The prevalence of acne (folliculitis) keloidalis nuchae (AKN) was higher in males than females (10.5% vs. 0.3%), and was not associated with whether clippers or blades were used. However it was associated with haircut symptoms. Haircut associated symptoms i.e. at least one episode of transient pimples (or crusts) and bleeding (however small) were reported in 37% and 18.9% of males respectively. The latter may have implications for disease transmission. The prevalence of traction alopecia (TA) and central centrifugal cicatricial alopecia (CCCA) were higher in females (31.7% vs. 2.6%) and (2.7% vs. 0%) respectively. CCCA was highest in females >50 years (6.7 % vs. 1.2 %). TA prevalence was highest if the usual hairstyle was extensions attached to relaxed hair (48%). AKN and CCCA tended to be more prevalent in the >50-75 yr than the oldest group, which for scarring conditions, may suggest external rather than inherent aetiological factors.

Limitations Random samples are more reliable but expensive, as a compromise this study included various adult groups.

Conclusions We found associations between specific scalp diseases, hairstyles, gender, and age. These associations need further study to better elucidate determinants and to improve

disease prevention and treatment.

Introduction

Hair is subject to various uses and abuses, which are influenced by current trends and hair phenotype. 'African' for the purpose of this paper refers to black tightly curly hair typical of indigenous Southern Africans.

Hair style complications may be as a result of mechanical trauma or chemicals used. Hair is commonly cut with electric clippers which are sold with plastic stages of various widths to give hair cuts of different lengths; the lowest stage gives a short haircut locally called the "brush cut." The plastic stages are often not used; instead the metal of the clipper is applied directly to the scalp and the hair cut against the grain. This gives a shave as close as that achieved with a razor blade, currently popular with African males.

Relaxers, usually sodium and guanidine hydroxide, are used to straighten African hair; when applied briefly (<5 minutes), create a slightly loose curl locally called an 's-curl' - if the hair is kept short, or a 'blow out' - if allowed to grow longer. Most females prefer straight long hair (relaxer applied for 10 – 20 minutes during processing). Relaxed hair for the variable "hairstyle on examination" and "current hairstyle" in this study is inclusive of all above groups. Permanent waves (perms) are performed with sodium thioglycolates were popular in the 1980s.

Both natural and chemically treated hair can also be braided as thin lines (cornrows), or individual thin or thick braids; in both cases with or without additional extensions. Sometimes the extension is attached only as a ponytail or as a'weave' (stitched or glued appearing wig-like) onto natural or chemically treated hair.

Anecdotal reports suggest that certain scalp disorders that may be associated with hair dressing are more common in individuals of African descent. These are acne (folliculitis) keloidalis nuchae (AKN)[1,2] - scarring pimples predominantly affecting the back of scalp; central centrifugal cicatricial alopecia (CCCA)[3] - centrally spreading permanent hair loss'[4] and traction alopecia (TA).[3,5] We reported in Chapter 2 a paucity of population studies on these conditions, including a lack of prevalence data. In Chapter 3 we reported a prevalence of TA of 17.1% in girls, and AKN of 2.2% in boys and found an association between AKN/TA and hairstyles.

Objectives

There were three objectives of this study:

1. To determine the prevalence of various hairstyles in African adults residing in Langa Township in Cape Town.
2. To determine the prevalence of specific scalp/hair disorders (TA, AKN, CCCA) and their variation with age and gender.
3. To describe possible associations between scalp disorders and hairstyles.

Methods

The study design was a cross-sectional study.

Setting and participants

Langa was established as an apartheid working class community for black Africans 10km from Cape Town City Centre and has a population of about 100 000. Although there is no complete record of churches and community organizations; those identified were invited to participate in the study through their committees and included:

1. ***Church group 1*** - Four out of more than 10 mainstream Christian churches were randomly selected. The latter are characterized by members wearing uniforms unique to their denomination.
2. ***Church group 2*** - One of many independent Christian and African traditional churches; specifically chosen because of its difference from other churches – it predominantly attracts young professionals and families.
3. ***Community organizations*** - a craft group (one of > 5 selected randomly) and the only social group of pensioners.
4. ***Hostels*** - Both groups of hostel dwellers (one at each end of the township). The hostels were originally built to accommodate migrant male workers and are in the process of being converted into family units. The majority of residents consider themselves rural having left family in the rural areas and returning for holidays and retirement.

Ethics

Ethical approval was received from our institution's Research Ethics Committee and initial consent was obtained from various committees to gain access to their membership. Finally informed consent was obtained from individual participants (all 18 years or older).

Sample size

A sample of 352 females and 706 males was required for TA and AKN respectively. Estimates were based on a pilot study reported with the children's study (Chapter 3). Because CCCA was not diagnosed in either the pilot study, a sample size was not calculated for it. The plan was to look for the disorders of interest (AKN/TA/CCCA) and document any other clinical diagnoses of scalp disease in all participants.

Assessments

A previously piloted questionnaire was administered by a trained assistant and included demographic data as well as questions including, past and present scalp symptoms, grooming methods, reasons for the choice of hairstyle and current and usual hairstyles. Examinations were performed by one dermatologist (NPK) to record the hairstyle and the clinical diagnosis if present. The only exception was males in church group 2 who were examined by an experienced colleague because of logistics. NPK was simultaneously examining females and available for consultation**.** Digital photography was used to record interesting hairstyles and disease findings. Statistical analyses were performed using STATA version 9.0 (STATA Corporation, College Station, TX). Prevalence figures were calculated as percentages and associations were compared using the Chi-squared test or Fisher's exact test. All significance tests were two-tailed and significance was defined at the 5% alpha level.

Results

Membership numbers for three out of four groups were unavailable and we were thus unable to calculate the proportion of responders. For church group 2 the response rate was 74% (258/350). During the eleven months (January 2006 to November 2006) funded for recruitment nearly double the calculated target number of females and less than half that of male participants

were enrolled. There was a significant gender difference across social groups; with a female predominance in churches and community organizations, and a male predominance in hostels (Table 4.1). Participants included 270 (30.9%) males and 604 (69.1%) females.

On examination natural hair was more common in men than women (91.7% vs. 24.3%). Irrespective of hairstyle the majority of men had recent haircuts [within 4 weeks (74.8% vs. 9.9%) of women]. This finding was similar when looking only at participants with natural hair (78.7% vs. 16.7%). More females recorded their current hairstyle as relaxed, than did males 49.7% vs. 2.2%. This was confirmed for relaxed hair on examination of the whole group 49.2% in women vs. 2.3% in men. Thus the majority of females had chemically treated hair: [58.7%: (49.2% relaxed and 9.6% permed hair) vs. 2.3%] in men. Females were more likely to have previously had many different hairstyles (Figure 4.1).

The prevalence of AKN in the whole group was 3.5%, 10.5% in males compared to 0.3% in females (Table 4.1, Figure 4.2). In spite of the number of males being only 38% (270/706) of the target sample size the prevalence of AKN was not different in the different social groups (p=0.660) (Table 4.2). Although AKN prevalence differed with age and appeared lower in the oldest group, this difference was not significant. The proportion with AKN in those with recent haircuts (within vs. > 4 weeks) previously was higher but not significantly so. The prevalence of AKN in males with brush cuts vs. clean shave cuts was 10.1% vs. 13.1%; similarly the use of clippers or razors made no difference (10.4% vs. 10.7% respectively). However haircut symptoms were associated with AKN prevalence (Table 4.2). Disease prevalence varied with haircut associated bleeding [never bled 6.6% (7/106), rarely bled 16.3% (7/43) and usually bled 37% (3/8)]. Thus of all males 18.9% (51/270) had had at least one episode of bleeding, however small, during a haircut while 37% (100/270) had had at least one other haircut related symptom (Table 4.2).

The prevalence of TA was 22.6% overall; 31.7% in females vs. 2.3% in males (Figure 4.3). In females TA prevalence was similar for "hairstyle on examination" in both natural (24.8%) and permed (22.8%) but was higher in long relaxed hair (33.6%) and combined hair styles [(40%) i.e. natural or relaxed combined with braids with or without extensions]. In addition there was a tendency toward a higher prevalence in participants with hairdressing symptoms than those without (Table 4.3). It is noteworthy that at least 24.3% (150/604) and 44.5% (269/604) of all females reported symptoms related to braids and relaxers respectively. The prevalence of TA

was higher if self reported "usual hairstyle" was relaxed hair and highest (48%) if extensions (braids, weaves) were attached to relaxed hair (Table 4). The prevalence was similar for natural hair and s-curl i.e. relaxed hair that is kept short. Six males were diagnosed with TA. Of these five had natural hair (two previously had braids and one had dreadlocks usually tied in a ponytail.

The overall prevalence of CCCA was 1.9% (Figure 4.4). It was confined to women (2.7%) and although it increased with age, tended to be lower in the oldest group (if the two participants who's scarring alopecia was in a patterned distribution were excluded (10/164) 6.2% vs. (1/27) 3.5%) for age groups >50 – 75 vs. >75 years respectively. Although CCCA was not associated with usual hairstyle, hairstyle on examination or hairdressing symptoms (Table 4.3), there was a trend toward a higher prevalence in participants who first relaxed > versus =<5 years previously [4.9% (10/207) vs. 1.3% (2/150): p= 0.175].

Discussion

Outcomes from studies where samples are randomly selected are more generalizable but also more expensive to obtain. As a result of limited funding we included community groups, as many participants could be examined at each visit. We included different groups in Langa in an attempt to maximize representativity. The latter 'convenience' samples may have inherent bias as there may be unknown characteristics unique to such groups.

The larger number of females in three out of four groups may suggest that males are less likely to belong to social groups than females. In spite of this however the prevalence of AKN in males was not significantly different in the different social groups. Thus the true prevalence of AKN in our adult male population is likely to be around 10%. In American football players the overall AKN prevalence was 13.6%;[1] 5.2% (8.1% in blacks, 0% in whites) vs. 9.4% (16.1% in blacks, 0% in whites) in high school vs. older players respectively. The prevalence of AKN in our adult population was about double that found in boys in the last year of school (4.7%). In addition AKN prevalence was insignificantly higher in participants with a haircut < vs. > 4 weeks. Many participants mentioned that they had haircuts every two weeks to maintain a clean shave look. Thus two weeks may have been a more sensitive cut off for detecting an association between haircut frequency and AKN. The association between AKN and haircut symptoms raises the question of what came first. The irregular scalp of patients with AKN would make it susceptible

to injury during haircuts. However symptoms and bleeding were reported even in participants without AKN suggesting that haircuts may contribute to disease pathogenesis. More worrying is the possible transmission of blood born infections by hair dressing implements; non mechanical methods of hair removal may be safer. One of the only two women with AKN reported that her symptoms started during a period when she kept a clean shave hairstyle, she now braids with artificial extensions to conceal the lesions.

In this study, as in school children, the prevalence of TA was significantly higher in females with relaxed hair than in those with natural hair. In addition, combined hairstyles were associated with a higher prevalence. The high prevalence of TA in relaxed hair, which is mostly combed back and worn in ponytails, is consistent with the hypothesis that traction is causal. Relaxed hair may be less resistant to traction[6,7] predisposing it to a higher risk of developing TA. The short waves of s-curls and the curls of permed hair are usually styled loose which may explain the lower disease prevalence than that associated with relaxed long hair.

The prevalence of TA in natural hair was higher than in males and in school girls (who had strict uniform hairstyle rules 5.2%). The latter is likely to reflect confounding as adult females are more likely to have had more hairstyles than girls and males. The prevalence of TA was lower when natural hair was styled into twists or dreadlocks, but this could be an effect of the small number of participants in this group. In addition TA prevalence was higher in both relaxed hair and braided natural hair compared to natural hair without braids; and was highest when traction was added to relaxed hair. The lower TA prevalence in dreadlocks compared to natural hair in braids + extensions (Table 4.4), possibly suggesting that traction from artificial extensions may cause more damage than that from natural long hair, but this finding requires confirmation.

The systematic review failed to identify any studies estimating the frequency of CCCA in any population and no cases were diagnosed in our school population. A small Nigerian clinic study[8] reported CCCA in 15.4% of 39 adult females presenting with hair loss and found an association with prolonged and frequent use of relaxers. We demonstrated an association between CCCA and age and gender but not with hairstyles. A recent series reported acute CCCA secondary to relaxer use.[9] Thus the lack of association of CCCA with hairstyle in this study may be a result of the small number of cases or may indicate confounding; when alopecia

becomes obvious, or as participants grow older, they tend to leave their hair natural. In two females with CCCA the distribution was similar to than seen in 'patterned hair loss' however without histology it was not possible to determine whether they would fit within the CCCA, lichen planus[10] or (androgenetic alopecia) AL[11] spectrum (Figure 4.5). The prevalence of AKN and CCCA in males and females respectively increased with age but tended to be lower in the oldest age group. If the latter were true for these scarring conditions, it could suggest that major disease determinants were not inherent (e.g. the unique African follicle shape and age) but the result of external factors most likely related to hairdressing trends. However this needs confirmation with larger numbers.

In conclusion, this study has found an association between hair style choice and the prevalence of specific scalp disorders. TA is common in females and is significantly associated with hairstyles, particularly braids and relaxed hair. CCCA has a low prevalence and is largely restricted to females among whom it tends to increases with age and duration of relaxer use; its association with specific hairstyles requires further investigation. AKN is more common in males, is associated with haircut symptoms which may have implications for disease transmission. The association of AKN with haircut frequency also requires further study. AKN and CCCA tended to be more prevalent in the age group > 50-75 year than that > 75 years, which for scarring conditions, may suggest external rather than inherent aetiological factors.

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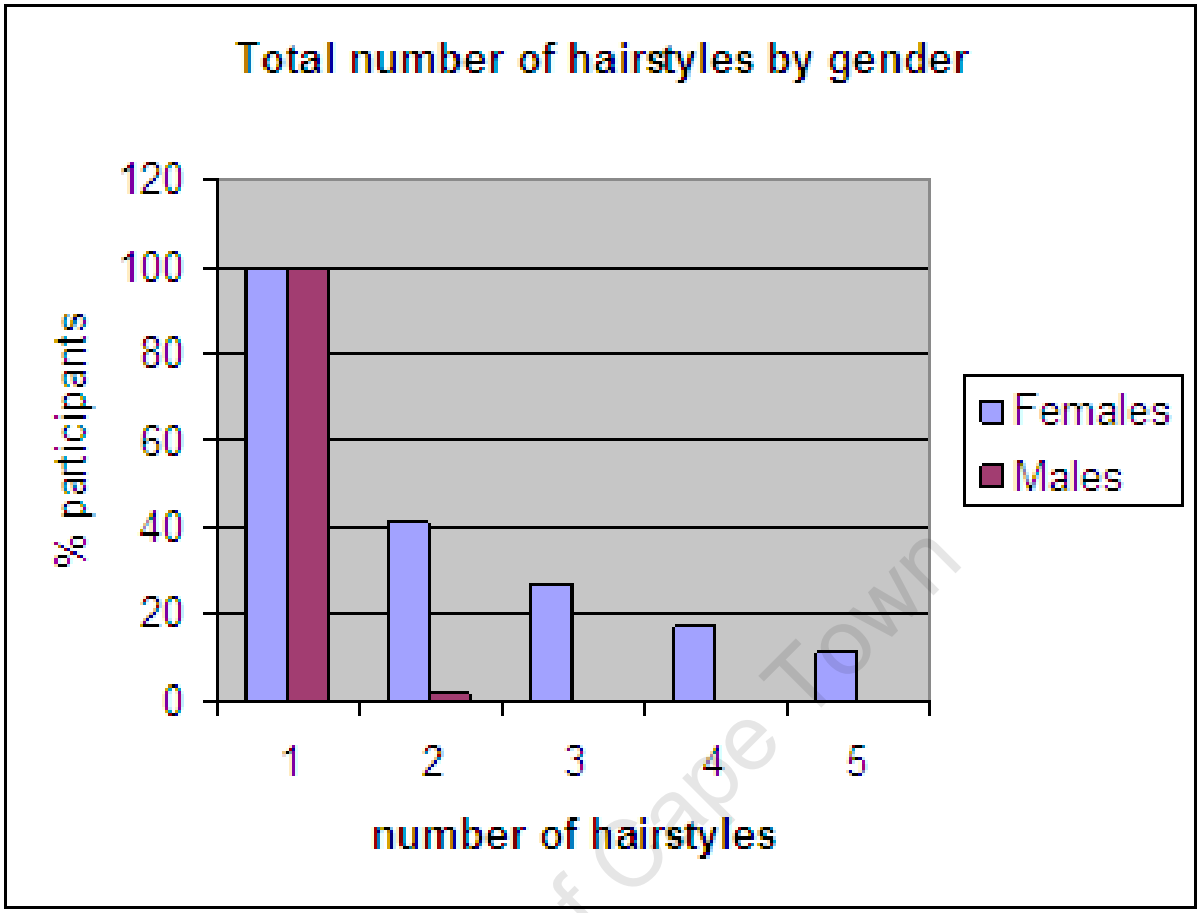
Figures



In response to the question "tick all hairstyles you have had performed on you" females ticked more than males

Figure 4.2

Male with established (folliculitis) keloidalis nuchae AKN

Figure 4.3

Chronic traction alopecia after stopping relaxers and braids, and allowing hair to grow out naturally

Figure 4.4

Female with early central centrifugal cicatricial alopecia

Figure 4.5

Female with clinically scarring "patterned alopecia"

Table 4.1 Characteristics of study population

Characteristic	Frequency (percentage)*			P-value
	Total	Females	Males	
Age group (years)				
18-25	196 (23.1)	131 (23.1)	65 (23.8)	
>25-50	370 (44.9)	245 (42.3)	125 (48.6)	
>50	258 (31.3)	192 (33.8)	66 (25.8)	
Total	824 (100)	579 (100)	257 (100)	0.071
Hairstyle on examination				
Natural	389 (45.3)	145 (24.3)	244 (91.7)	
Relax	299 (34.7)	293 (49.2)	6 (2.3)	
Permed	57 (6.6)	57 (9.6)	0 (0.0)	
*Other***	117 (13.7)	101 (17.0)	16 (6.0)	
Total	862 (100)	596 (100)	266 (100)	<0.0001 [a]
Time since last hair cut				
Less than 1 month	262 (30.0)	60 (9.9)	202 (74.8)	
1month or more	612 (70.0)	544 (90.1)	68 (25.2)	
Total	874 (100)	604 (100)	270 (100)	<0.0001 [a]
Social group				
Church group 1	314 (35.9)	250 (41.4)	64 (23.7)	
Church group 2	258 (29.5)	179 (29.6)	79 (29.3)	
Community organizations.	91 (10.41)	79 (13.1)	12 (4.4)	
Hostels	211 (24.1)	96 (15.9)	115 (42.6)	
Total	874 (100)	604 (100)	270 (100)	<0.0001[a]
Acne keloidalis				
Yes	30 (3.5)	2 (0.34)	28 (10.5)	
No	669 (96.5)	595 (99.7)	239 (89.5)	
Total	864 (100)	597 (100)	267 (100)	<0.0001[a]
Traction alopecia				
Yes	195 (22.6)	189 (31.7)	6 (2.3)	
No	834 (77.4)	408 (68.3)	261 (97.8)	
Total	864 (100)	597 (100)	267 (100)	<0.0001[a]
Central centrifugal cicatricial alopecia				
Yes	16 (1.9)	16 (2.7)	0 (0.0)	
No	848 (98.1)	581 (97.3)	267 (100.0)	
Total	864 (100)	597 (100)	267 (100)	0.011[a]

*Values are count/total (proportion). Denominators differ due to missing values.

[a] p-value based on Chi-squared test of association or Fisher's exact test, for difference between females and males

** Other: includes combinations (natural, relaxed, or permed with cornrows, braids, extensions or dreadlocks)

Table 4.2 AKN prevalence in male participants by characteristics

Characteristic		Participant frequency (% with AKN)
Age group (years)		
18-25		65 (7.7)
>25-50		124 (13.7)
>50		64 (6.3)
Total		253
P-value[a]		0.204
Hairstyle on examination		
Natural		244 (10.7)
Relax		6 (16.7)
Permed		0 (0.0)
*Other***		16 (6.3)
Total		266
P-value[a]		0.691
Last haircut < 4 weeks		
Yes		99 (12.1)
No		68 (5.9)
Total		167
P-value[a]		0.175
Haircut symptoms		
Never		124 (3.2)
Sometimes have crusts		21 (14.3)
Sometime have pimples		42 (19.1)
Usually have pimples		28 (14.3)
Always have pimples		9 (44.5)
P-value[a]		0.0001
Social Group	**Median age in years (range)**	
Church group 1	*41.8 (18.9;82.6)*	62 (12.9)
Church group 2	*24.7 (18;99.0)*	79 (8.9)
Community Organizations	*65.3 (41.3;91.0)*	12 (0.0)
Hostels	*37.4 (18;76.7)*	114 (11.4)
Total	*34.1 (18;99.0)*	267
P-value[a]		0.660

*Values are count/total (proportion). Denominators differ due to missing values.

[a] p-value based on Chi-squared test of association or Fisher's exact test, for difference across strata

**Other: includes combinations (natural, relaxed, or permed with cornrows, braids, extensions or dreadlocks).

Table 4.3 Traction alopecia and central centrifugal cicatricial alopecia by patient characteristics in females

Characteristic		Frequency (%)		
		Number	TA	CCCA
Age group (years)				
18-25		129	37 (28.7)	0 (0.0)
>25-50		241	84 (34.9)	3 (1.2)
>50		191	56 (29.3)	13 (6.7)
Total		561		
P-value[a]			0.341	0.001
Hairstyle on examination				
Natural		145	36 (24.8)	9 (6.2)
Relax		292	99 (33.6)	5 (1.7)
Permed		57	13 (22.8)	1 (1.8)
*Other***		101	41 (40.6)	1 (0.99)
Total		595		
P-value[a]			<0.0001	0.144
Hair dressing related symptoms (ever)				
Tight braids		108	42 (38.9)	1 (0.93)
Tight braids with pimples		42	15 (35.7)	0 (0)
Stinging from relaxer		196	65 (33.2)	8 (4.1)
Stinging from relaxer healing with crusts		73	24 (32.9)	2 (2.74)
No symptoms		178	43 (24.2)	4 (2.25)
P-value[a]			0.099	0.875
Social Group	**Median age in years (range)**			
Church group 1	*44.0 (18;77.0)*	244	89 (36.5)	12 (4.9)
Church group 2	*24.5 (18;77.2)*	179	50 (27.9)	1 (0.6)
Community organizations	*71.2 (38.3;86.0)*	78	26 (33.3)	3 (3.9)
Hostels	*38.5 (18;68.0)*	96	24 (25.0)	0 (0.0)
Total	*38.2 (18;86.0)*	597		
P-value[a]			0.120	0.034

*Values are count/total (proportion). Denominators differ due to missing values.

[a] p-value based on Chi-squared test of association or Fisher's exact test, for difference across strata

**Other: includes combinations (natural, relaxed, or permed with cornrows, braids, extensions or dreadlocks)

Table 4.4

Traction alopecia prevalence by participant recorded usual hairstyle, in adult females

Variable	Frequency (%)								
TA present	**Total**	**Natural**	**Natural + braids**	**Natural + braids + extensions***	**Natural dread locks/twists**	**Relax straight long**	**Relax + braid extensions***	**Relax short (S-curl)***	**Perm***
Yes	175	25 (21.6)	5 (33.3)	9 (39.1)	3 (23.1)	91 (35.4)	25 (48.1)	3 (20.0)	11 (19.3)
No	462	91 (78.5)	10 (66.7)	14 (60.9)	10 (76.9)	166 (64.6)	27 (51.9)	12 (80.0)	46 (80.7)
Total	637	116	15	23	13	257	52	15	57

*Extensions include exogenous attachments e.g. braid extensions attached as corn rows or individual braids and weaves (stitched or glued on)

** The wave of s-curled and curls of permed hair are usually styled loose

Chapter 5

Marginal Traction Alopecia Severity Score – development and test of reliability

Chapter abstract

Background Traction alopecia (TA) is common in African females. Although hairstyles are thought to be causal, the contribution of individual hairstyling variables to TA severity has not been quantified. The aim of the current study was to develop a severity scoring system (M-TAS score) for marginal TA, the commonest form of this disorder, and to test its reliability.

Method The margins of the scalp were divided into anterior and posterior with an imaginary lining joining the tips of both ears. The anterior and posterior hairlines were further divided into three using the temporalis muscles and mastoid processes at the hairline as land marks respectively. Each examiner assessed each of the six areas. If any were found to have TA the severity was scored using an examiner assessed system (tested once) or a picture matched score (tested twice). Ten and eight female patients with TA of varying severity were assessed by eleven and nine examiners (dermatologists, dermatology trainees and nurses) respectively.

Results The intra class correlation coefficient (ICC) for interobserver agreement was larger with photograph-matched scores than with examiner estimated scores reaching substantial (0.61-0.80) and excellent (0.81-100) agreement for both anterior and posterior scores irrespective of level of skill of examiner. The ICC for intraobserver agreement with the photograph matched scores was 0.99.

Limitations The diagnosis of normal margin was excellent for the anterior yet poor for the posterior margin with photograph scores. The M-TAS score is not for diagnosis but to assess severity.

Conclusion The photograph based M-TAS score requires validation with larger samples but could be a useful research tool for elucidating disease prevalence and determinants of TA as well for monitoring response to treatment.

Introduction

The term traction alopecia (TA) was introduced in 1946 [1] as a name for a form of hair loss previously described in people from Greenland. Although the exact mechanism is still uncertain, traction is thought to induce inflammation, presenting as folliculitis (i.e. perifollicular papules and pustules in affected areas)[2]. In many patients, the inflammation is subclinical and the usual presentation is progressive hair loss affecting any part of the scalp (or body) where traction is applied, the commonest area being the anterior scalp margin. TA is thought to be reversible if interrupted early but may eventually be permanent.

TA can affect people of any geographic, cultural or occupational background and has been reported in European women,[3] ballerinas, Sikh men,[4] nurses[5] and Japanese women (chignon alopecia),[6] but seems to be more commonly reported in people of African descent [7-11] including children.[12] A prevalence of 33% has been reported in a volunteer sample of 110 African women.[13] However, it is still unclear the extent to which variables such as different chemicals (e.g. relaxers, perms), type of braids (singles, cornrows) and type of extensions (synthetic, human hair) contribute to the development of TA.

A scoring system for assessing the severity of TA is necessary. Such an instrument could be used to elucidate the contribution of individual variables to disease pathogenesis and also enable the design of studies to assess treatment effectiveness and clinical follow up of patients. We recently reported anecdotal response of TA to treatment with 2% topical Minoxidil.[14] The aim of the current study was to develop and test the reliability of a severity scoring system for marginal TA, the most common form of TA.

Methods

The study was conducted at an academic Dermatology unit in Cape Town in the first half of 2005. TA is commonly called *injibhabha* in the local language. Hospital workers who considered themselves to have TA were invited, by word of mouth to participate, in the study (the diagnosis was confirmed by a consultant dermatologist - NPK). Staff members in the unit (dermatology consultants, dermatology trainees and specialist nurses) were recruited to perform the assessments. A brief training session was conducted on the use of the assessment tool. The aim was to include ten patients with TA of varying severity and at least 9 examiners of varying staff

grade (consultants, registrars and nurses).

Anatomical regions for the scoring instrument

The margins of the scalp are divided into the anterior and posterior regions using an imaginary line that joins the anterior tips of both ears. The anterior margin is then divided into three areas using the medial edges of the temporalis muscles at the hair line as a landmark. The latter muscles are palpable when the patient clenches both jaws. The posterior margin is divided by using the mastoid prominences as landmarks. The sternocleidomastoid muscle is palpable with the head fully turned to the opposite side and can be followed from the sternum to the mastoid process above where it inserts behind the ear. The posterior margin is also divided into three by using the ears and medial margins of the mastoid prominences at the hair line (Figure 1).

Scoring system

Pilot study I

A pilot study (pilot study I) was conducted to test how easy it was to perform the scoring, to estimate agreement between assessors and get suggestions from them for improvements. Initial assessments were performed with 10 female patients (age 25 – 50 years) presenting with TA of varying severity by 11 examiners (4 dermatologists, 4 dermatology registrars, 3 nurses). After a brief training session, each examiner scored each patient (for each of the six scalp margins described above) as follows:

1. Is there short/thin hair or hair loss, consistent with TA, within area margins?

If no hair loss, score = 0; if yes, go to next question

2. Is this short/thin hair > 50% of distance between, or width of, area margins?

If no, score = 1; if yes, go to next question

3. Is there a bald patch(es)?

If no, score = 2; if yes, score = 3

The maximum score for each area was 3, and 9 each for the anterior and posterior margin; giving a total score of 18.

Pre - Pilot study II

A review session to consider feedback from examiners was held after the first pilot study. Examiners felt the anatomical divisions of the margins were sensible but found the scoring confusing because of too many questions. The main suggested improvement was that the bald patches need to be graded in order to separate mild from severe. As a result a fourth grade was added, and the examiner now assessed how much of the distance between the area landmarks was affected by thin/short hair or had bald patch(es) i.e. <50% or >50%. The maximum score for each area was 4 and was assessed as follows:

Normal looking area = 0; short/thin hair involving <50% of the width of the area = 1; short/thin hair >50% of the width of the area = 2; bald patch(es) <50% of the width of the area = 3; and bald patch(es) >50% of the width of the area = 4.

If one area had both short hair and a bald patch(es), the higher score was entered. This increased the score to 12 for each the anterior and posterior margins. Although examiners were happier with this scoring system than the first, when we tried to apply the system to clinical photographs it became apparent that occasionally bald patches occupied <50% of the distance between area margins but appeared as severe as thin bald patch affecting > 50% of the distance. A final decision was taken to make the entire scoring based on matching patients to clinical photographs, thus freeing the examiner from answering questions and trying to distinguish whether more or less than 50% of an area was affected.

Pilot study 2 (Figure 1)

Eight female patients (age range 23-52 years) with TA of different severity were scored by nine examiners (4 dermatologists, 3 registrars and 2 nurses). Each examiner scored each patient twice. The scoring system was based on using four clinical photographs of TA of increasing severity, graded from 1-4. The photographs were of the front lateral margin. For each of the six areas the examiner had to decide if the margin looked normal, in which case a score = 0 was entered. If the area was consistent with TA the examiner chose a photograph that best matched the patient hair loss, and the corresponding number 1-4 was entered as a score. The maximum possible score was 12 for each anterior and posterior margins (giving a combined total score of 24 for marginal TA).

Statistical methods

The interobserver and intraobserver variability were estimated using analysis of variance (ANOVA). To determine interobserver variability in the scores, intraclass correlation coefficients (ICC) were calculated. ICC for agreement were calculated from estimated variance components using Genstat (version 9.1) and STATA (version 9.0). Kappa statistics were calculated to assess the agreement of evaluators in the diagnosis of normal margins, by separating scores into two categories, i.e. a score = 0 vs. > 0. The strength of agreement for both ICC and kappa were interpreted as follows: ≤ 0.40 poor to fair agreement; 0.41-60, moderate agreement; 0.61-80, substantial agreement; 0.81-100, almost perfect agreement.[15]

Results

Tables 2 and 3 present the examiner estimated and photograph matched scores respectively. Each of the latter scores is the sum given by each examiner for the total margin (each made up of three areas for anterior and posterior). We observed that within each study and margin there was considerable variability among subjects but that inter and intraobserver variability was relatively small (Table 4). The overall intraobserver agreement for pilot study II was very high [ICC: 0.997 (0.980, 1.000) for anterior and ICC: 1.000 posterior margins respectively based on variability from Table 4].

Overall, interobserver agreement was better based on photograph-matched scores than for examiner estimated scores (Table 5) with photograph scores reaching substantial (ICC = 0.61-0.80) or almost perfect (ICC = 0.81-100) agreement for both anterior and posterior scores irrespective of level of skill of examiner. Based on ICC values, dermatologists and nurses tended to show higher interobserver agreement than registrars on examiner estimated scores. All groups of examiners shared consistently high ICC in the photograph based scores.

Agreement on abnormality of the hairline (i.e. presence of TA) for the anterior margin was perfect as no examiner mistakenly recorded any patients' score as = 0. However the agreement of examiners on abnormality of margin for the posterior score (i.e score = 0) was poor and was better in all staff categories using the examiner assessed scores than the photograph scores (Table 5). That is examiners tended to match photographs for posterior margins even for margins they had diagnosed as normal with examiner assessed scores, thus most of the

disagreement occurred with very low scores 1 - 3 (Table 5).

Discussion

This study found an improvement in the interobserver ICC using the photographic scores in both anterior and posterior margins irrespective of the category of clinician using the tool. Although nurses tended to get higher scores than dermatology trainees this was not statistically different.

Anterior marginal TA is more common than that of the posterior margin. Thus the most common maximum score that can be expected is 12/24 which, although severe does not appear as such when anterior and posterior scores are combined. It is thus more useful not to add up the scores but rather to enter the numbers in a table similar to that in Figure 2, which allows for quick and easy review of patients both for clinicians and researchers.

Kappa scores were used to calculate how often examiners assessed a margin as normal i.e. score = 0 vs. > 0. In this study all patients had at least one of the three anterior hair line margins affected; all examiners assessed the patients as such, suggesting perfect agreement. The posterior margin kappa scores were worse with the photographic than the examiner estimated scores. This latter finding may suggest that examiners were so keen to match the hair line with photographs that they forgot that they had to first make a diagnosis of TA, a point which should be emphasized during training. It is also possible that including posterior margin pictures in future scoring systems could be useful - none were used in this study.

It may be argued that the depth or distance of the alopecia from the hair line toward the center of the scalp should be quantified. However taking measurements would complicate the scoring system as the shape of the hairline may vary, even within the same person (left and right), and the width may be different at two points within the same area of alopecia. We believe that hair loss compared with a picture score is a more reliable estimate of disease severity than examiner estimated methods. However this tool cannot replace the clinician for the diagnosis of TA.

It is important to remember that the M-TAS score is not a diagnostic tool. The examiner has to first make a diagnosis of TA for each area before matching the picture to grade severity. We conclude that with ICC in the range of 0.79 – 0.90, this is a reliable tool for assessing TA

disease severity. Application in the field and further validation studies are needed to improve the utility of this instrument.

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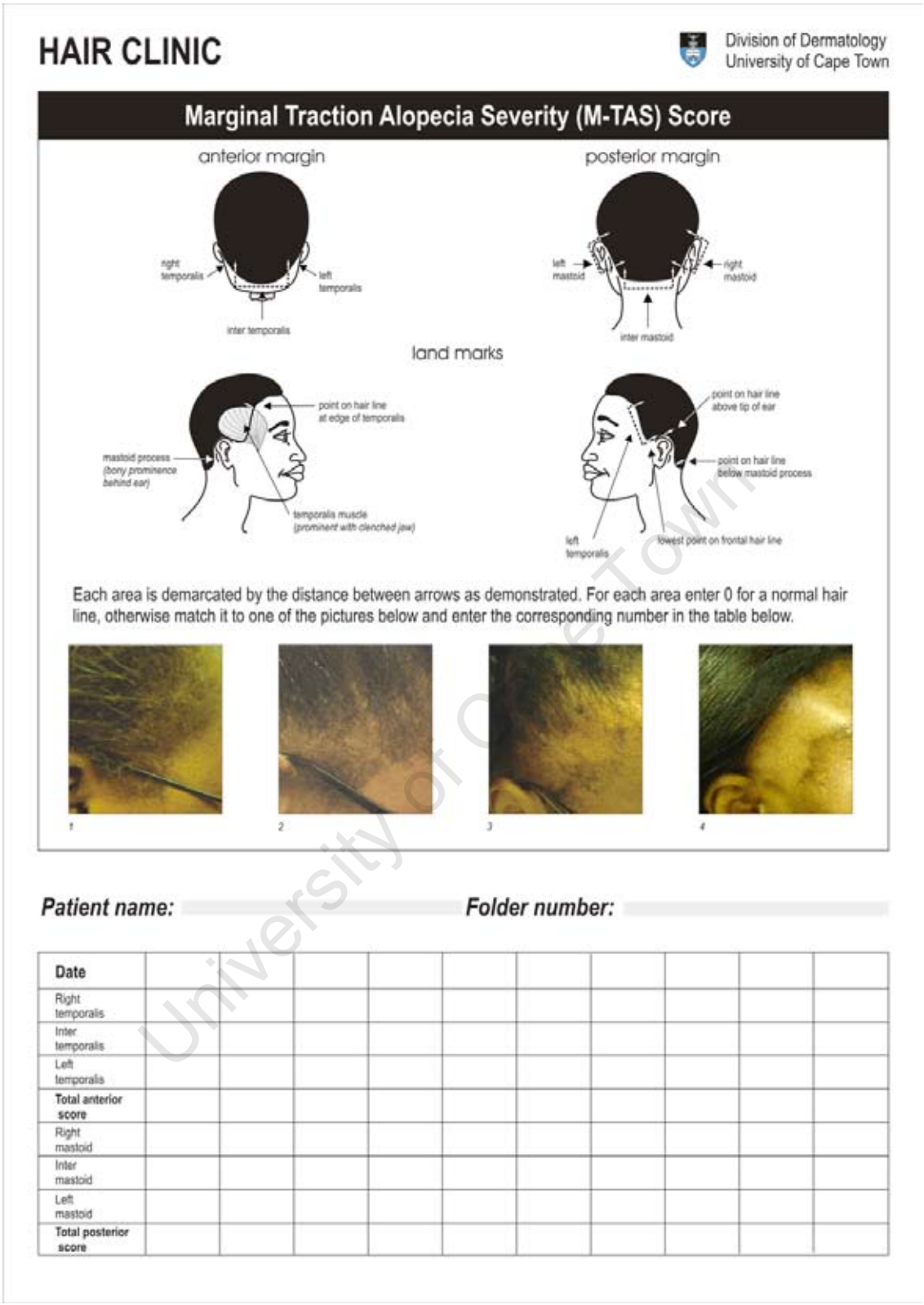
Figure 5.1



HAIR CLINIC

Division of Dermatology
University of Cape Town

Marginal Traction Alopecia Severity (M-TAS) Score

anterior margin

posterior margin

land marks

Each area is demarcated by the distance between arrows as demonstrated. For each area enter 0 for a normal hair line, otherwise match it to one of the pictures below and enter the corresponding number in the table below.

Patient name: ***Folder number:***

Date									
Right temporalis									
Inter temporalis									
Left temporalis									
Total anterior score									
Right mastoid									
Inter mastoid									
Left mastoid									
Total posterior score									

Complete tool for assessing and recording traction alopecia severity and change with time

Table 1 Anatomical areas used for scoring of traction alopecia severity

ANTERIOR MARGIN OF SCALP		
Area	**Margin delineation**	**Summary**
Right temporalis	from right ear to medial edge of right temporalis	**overlies right temporalis muscle at the hairline**
Left temporalis	from left ear to medial edge of left temporalis	**overlies left temporalis muscle at the hairline**
Inter temporalis	between medial margins of left and right temporalis muscles	**between both temporalis muscles at hair line**
POSTERIOR MARGIN OF SCALP		
Right mastoid	between right ear and medial edge of mastoid at hair line	**overlies right mastoid prominence at hair line**
Left mastoid	between left ear and medial edge of the mastoid at hair line	**overlies left mastoid prominence at hair line**
Inter mastoid	between lower medial edges of both mastoid at hair line	**overlies nape between mastoid prominences at hair line**

Table 5.2 – Examiner estimated scores of traction alopecia severity

Patients	Evaluators									
	C[1]	C[2]	C[3]	R[1]	R[2]	R[3]	R[4]	PN[1]	SN[1]	SN[2]
1 (A) Ant.	8	9	2	6	9	6	9	6	2	5
Post.	3	1	0	0	3	1	6	4	2	1
2 (B) Ant.	5	8	2	7	3	3	7	4	2	4
Post.	0	0	0	0	0	0	0	0	0	0
3 (C) Ant.	9	9	9	9	9	5	9	9	8	9
Post.	5	5	5	6	5	2	6	6	3	6
4 (D) Ant.	3	8	2	2	5	2	7	5	2	6
Post.	2	2	1	0	0	4	4	5	5	4
5 (E) Ant.	3	8	3	2	3	2	6	4	2	3
Post.	2	2	0	1	0	0	2	3	2	3
6 (F) Ant.	2	5	5	9	3	2	4	2	3	1
Post.	0	0	0	0	0	0	0	0	0	1
7 (G) Ant.	3	9	4	7	5	2	7	5	4	2
Post.	1	3	3	6	3	0	5	2	3	0
8 (H) Ant.	5	8	5	9	8	4	6	7	2	6
Post.	3	3	4	6	2	0	5	3	0	0
9 (I) Ant.	4	4	2	2	4	2	3	2	2	2
Post.	1	1	1	0	3	3	3	4	1	2
10 (J) Ant.	4	6	1	4	2	2	5	5	2	5
Post.	0	0	0	0	0	0	0	0	0	0

Capital letters with superscript represent examiner identifier

- C - Consultant dermatologist
- D - Dermatology Registrar
- PN - Professional nurse
- SN - Staff nurse

Table 5.3 Photograph matched scores in anterior and posterior margins.

Patients	Evaluators																	
	C[1]		C[3]		C[4]		R[1]		R[2]		R[3]		R[4]		SN[3]		SN[4]	
1 (A) Ant.	11	11	8	9	7	9	8	8	8	8	4	5	8	9	8	9	11	12
Post.	1	2	3	2	0	2	0	0	2	2	0	0	5	6	0	3	0	0
2 (C) Ant.	12	12	12	12	12	11	11	12	12	12	12	12	12	12	12	12	8	12
Post.	6	6	8	6	9	6	9	9	9	9	6	5	8	11	9	9	9	9
3 (E) Ant.	5	5	5	6	5	7	2	4	4	5	3	3	4	8	2	3	6	9
Post.	1	1	2	2	0	0	0	0	0	0	0	0	1	1	0	1	2	2
4 (F) Ant.	2	2	4	4	3	3	2	2	5	5	1	2	2	2	2	2	4	3
Post.	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1
5 (G) Ant.	6	5	7	6	4	5	7	7	8	8	3	5	5	8	4	4	4	4
Post.	1	1	2	2	0	3	0	0	2	2	2	3	2	3	0	0	0	0
6 (K) Ant.	8	8	9	8	7	6	8	9	8	8	9	7	9	9	9	10	4	7
Post.	2	2	3	2	3	3	3	2	2	3	0	0	3	3	3	3	0	0
7 (I) Ant.	2	2	4	2	3	2	2	2	2	2	2	3	2	2	2	2	2	2
Post.	1	1	1	2	1	1	0	0	3	1	1	1	1	1	1	0	1	0
8 (L) Ant.	2	2	4	4	2	2	2	2	3	3	2	2	2	2	2	2	2	2
Post.	1	1	1	1	1	1	0	0	0	1	0	0	0	0	0	1	1	1

Capital letters with superscript represent examiner identifier

- [1]Consultant dermatologist
- [2]Dermatology Registrar /(trainee)
- [3]Staff nurse

Table 5.4 Interobserver, intraobserver and between-subject variability of scores.

Pilot Study	Margin	Interobserver (std. error)	Intraobserver (std. error)	Between-subject (std. error)
I	Anterior	1.675 (0.85)		2.79 (1.41)
	Posterior	0.163 (0.16)		2.22 (1.12)
II	Anterior	0.195 (0.15)	0.05 (0.11)	11.52 (6.21)
	Posterior	0.182 (0.13)	0.00 (0.02)	6.22 (3.36)

Interobserver and intraobserver variabilities were estimated using analysis of variance (ANOVA)

Study I: Examiner estimated scores

Study II: Photograph matched scores

Table 5.5 Interobserver agreement by examiner staff category: ICC and Kappa values.

Study/ Margin	Dermatologists	Registrars (trainees)	Nurses	Overall
Study I				
Anterior				
*ICC**	0.39 (0.003, 0.676)	0.38 (0.041, 0.713)	0.56 (0.198, 0.914)	0.42 (0.155, .687)
Posterior				
*ICC**	0.74 (0.517, 0.960)	0.38 (0.045, 0.718)	0.67 (0.378, 0.956)	0.53 (0.275, 0.791)
*Kappa***	0.78 (0.527, 1.000)	0.33 (0.080, 0.587)	0.57 (0.217, 0.927)	0.54 (0.457, 0.625)
Study II				
Anterior				
*ICC**	0.91 (0.815, 1.000)	0.87 (0.741, 1.000)	0.79 (0.569, 1.000)	0.86 (0.723, 0.989)
Posterior				
*ICC**	0.86 (0.709, 1.000)	0.79 (0.594, 0.993)	0.90 (0.790, 1.000)	0.82 (0.664, 0.982)
*Kappa***	0.371 (0.191, 0.550)	0.301 (0.170, 0.432)	0.122 (0.000, 0.405)	0.153 (0.097, 0.209)

* ICC = Intraclass correlation coefficient.

** Kappa statistics were calculated to assess the agreement of evaluators in the diagnosis of normal margins i.e. a score = 0 vs. > 0.

Study I: examiner estimated scores

Study II: Photograph matched scores

Chapter 6

Chapter abstract

Background Traction alopecia (TA) is prevalent in African school girls (17.1%) and is most common in adult females (31.7%). Disease presence is associated with hair styles. The aim of this study was to investigate determinants of TA presence and severity in females using data from two population studies.

Methods Clinical assessment and the marginal traction alopecia severity (M-TAS) score were used for diagnosis and disease severity respectively. The first analysis was multiple logistic regression for disease presence. Exploratory association between disease severity and relevant variables were assessed using the Wilcoxon rank-sum test.

Results There were 574 girls and 604 adult women [median age 30.4 range 6.3 to 86 years]. More girls had chemically treated hair than women; 78% [all relaxed] vs. 58.7%: [49.2% relaxed and 9.6% permed hair] respectively. The odds ratio (OR) for TA presence was higher in adults than children [1.87 (p: 0.001, CI 1.28 – 2.72), and was higher with symptoms related to braiding than those related to chemicals. The highest risk of TA presence, compared to natural short hair, occurred when traction was added to relaxed hair [OR 3.47 (p: <0.001, CI 1.94 – 6.20)]. TA severity was associated with age group, current hairstyle and hair dressing symptoms; however participants with severe disease were too few to estimate determinants.

Limitations There is need for the validation of the M-TAS with larger numbers and future studies including more participants with severe disease.

Conclusions Avoiding inducing symptoms during hairdressing and the addition of traction to relaxed hair may be important for disease prevention.

Introduction

The condition now known as traction alopecia was first reported by an Austrian dermatologist who gave it the geographic name 'Alopecia Groenlandica' [1,2] (as referenced by Hjorth).[3] From early on hair styles were thought to be causal by such authors as Balina in 1933 (as referenced in Slepyan).[4,5] The term traction alopecia (TA) was first used in 1946.[6] In response to the lack of published population prevalence data (Chapter 1), we undertook community based cross sectional studies of scalp diseases including TA (Chapters 3 and 4).

The prevalence of TA among school children (Chapter 3), was 17.1% in girls and 0% in boys. In girls the prevalence increased with age from 8.6% in the first year of junior school to 21.7% in the last year of high school. Even though school rules restricted the variety of hairstyles, an association between TA prevalence and hairstyles was demonstrated, being much higher in participants with relaxed long than in those with natural short hair (19.4% vs. 1.4% respectively).

In adults the TA prevalence was 22.6%; 31.7% in females vs. 2.3% in males (Chapter 4). TA was associated with type of hairstyle found on examination. While a similar prevalence was demonstrated in natural hair (24.8%) and permed hair (22.8%), the prevalence was higher in long (straight) relaxed hair (33.6%) and in combined hair styles (i.e. natural/relaxed/perm + braids/extensions/weaves) (40%). The short waves of s-curls and curls of permed hair are usually styled loosely which may explain the lower prevalence of disease than that associated with relaxed long hair which is usually combed back and held in ponytails. The TA prevalence for self reported "usual hairstyle" was highest (48%) where traction (braid extensions, weaves) was applied to relaxed hair.

Objectives

The aim of this study was to determine predictors of TA presence and severity. This study was designed to assess whether specific variables made a difference to disease presence and severity: variables included how much money was spent per hairdressing session, symptoms starting during hair dressing and whether hair dye had ever been used; in addition to those specifically recommended for relaxed hair: how frequently the hair was relaxed (usual recommendation 6 - 8 weeks), having hair relaxed at a salon and whether or not "deep salon conditioning" (locally referred to as "treatment") was done between relaxing.

Methods

The analysis was performed on data from two cross-sectional studies in 1042 school children[8] and 874 adults[9] in Langa, Cape Town. School children were in their first and last years in two primary and two high schools in Langa Township in Cape Town (randomly selected out of six primary and four high schools respectively). Adults included two groups of Christian churches (denominations and independent churches) and community groups in the same township.

As described in Chapter 3 and 4, data were collected using a previously piloted questionnaire and assessments were made by one dermatologist (NPK). Clinical diagnosis was used for the presence of TA. A Marginal Traction Alopecia Severity (M-TAS) Score, an instrument designed for the study was previously tested for reliability (Chapter 5). The highest possible score is 12 for each anterior and posterior hair line margin (Figure 5.1 in Chapter 5). TA predominantly affects the anterior hairline; the score was categorized for analysis as: 1-3 = mild, 4-6 = moderate and >6 = severe.

Three variables for hairstyle were used: current and usual hairstyle (as reported by participants) and hairstyle on examination. The latter was subdivided into: natural short, relaxed short (s-curl)/permed, relaxed long and combined hair styles (natural/relaxed/perm + braids/ extensions/weave). S-curl and permed hair (when either kept short or when not "touched up" for long – in which case both appear as an 'afro') can be difficult to distinguish on inspection; similarly so with combined hair styles. Because participants could be more specific about hair procedures, self reported current and usual hairstyles had more categories. However, some categories had very few participants and in order to simplify analysis "usual" (and "current")

hairstyles were recoded for this study as shown in Table 6.1.

Specific variables of interest were: how much money was spent per hairdressing session [<50, 50 -100, >100 South African Rand, (exchange rate during study: SA R6.5 = USA $1)], whether hair dye had ever been used (yes, no) and symptoms starting during hair dressing (no symptoms, tight painful braids, tight painful braids resulting in pimples, stinging from relaxer and stinging from relaxer healing with crusts – separated to distinguish severity).

A separate analysis was done to investigate whether recommendations often made to people with relaxed hair made a difference to TA presence and severity i.e. the frequency of relaxing (<5, 5-8, >8/when money available), having hair relaxed at a saloon (yes, no, sometimes), and having salon "deep/intensive conditioning" locally called "treatment" done between relaxing (yes, no, when money available).

Statistical analyses were performed using STATA version 9.0 (STATA Corporation, College Station, TX). Two statistical methods were used in the analysis. The first was multiple logistic regression to identify determinants of TA presence. The second analysis was an exploration of associations for disease severity using the Wilcoxon rank-sum test for ordered groups. All significance tests were two-tailed and significance was defined at the 5% alpha level and 95% confidence intervals (CI).

Results

There were 1178 females (median age 30.4 years range 6.3 to 86 years), [574 school girls and 604 adult women (median age 17.4 years range 6 to 21 years, 38.3 years range 18 to 86 years respectively)]. A higher proportion of girls than women had chemically treated hair; 78% (all relaxed) vs. 58.7% (49.2% relaxed and 9.6% permed hair) respectively. For this analysis adults were defined as age =>18 years old, even if they were recruited for the study in schools. On univariate analysis the odds of TA presence was higher in adults than children [OR= 1.76 P: <0.001 95% CI 1.23 - 2.50)]. There was also variation across different age categories (Table 6.2).

Because of intercorrelation between the three hairstyle variables, three different multivariate models were fitted. In the "usual hairstyle" model the only style different from natural short hair was the relaxed + traction category. However, for "hairstyle on examination" and "current hairstyles" there was an increased odds of TA in all categories compared to natural

short hair, except for the s-curl + perm category. The highest odds was in the 'combined' [OR= 3.78 (P: <0.001, 95% CI 2.05 – 6.35)] and 'relaxed + traction' categories [OR= 3.47 (P: <0.001, 95% CI 1.94 – 6.20)] respectively.

Although the lowest amount spent per session of hairdressing had a lower odds of disease (suggesting that cheaper hair procedures are protective e.g. haircut vs. relaxers or braids), the association was attenuated when analysis was controlled for age. Whether hair dye had ever been used or not also did not alter the odds of disease. The presence of symptoms starting during hair dressing was associated with an increased odd of TA in most categories compared with having no symptoms. It is noteworthy that the odds of TA presence seemed higher with symptoms related to braids, however not severity, than those related to the use of chemicals (Table 6.2).

The initial analysis for TA severity demonstrated that the majority of participants diagnosed with TA had either mild or moderate disease, only very few had severe disease (9/286; 3.2%). We found an association between disease severity with age group (being higher in adults than children), "current hairstyle" (higher in natural+ braids) and symptoms starting during hair dressing. There was no association between disease severity and "usual hairstyle" or "hairstyle on examination" (Table 6.3). Neither was there an association between disease severity and how much money was spent on hairdressing nor whether the hair had ever been dyed. On univariate analysis no altered odds of TA severity was demonstrated with any of the three hairstyle variables, possible because of few participants in the severe group.

The variables in the subgroup analysis, performed on participants with relaxed hair to investigate specific recommendations, were also fitted into a regression model for TA presence. Neither usual hairdresser (salon, neighbor/friend) nor saloon conditioning between relaxing altered the odds of TA presence on univariate analysis. The overall regression analysis for TA presence was significant (P: 0.0361), with only age group [OR= 1.61 (P: 0.023, CI 1.07 - 2.44)] and one category of all symptom categories i.e. "tight braids resulting in pimples." [OR= 2.34 (P: 0.047, CI 1.01 - 5.41)] being significant. The 'frequency of relaxing' did not alter the odds of TA presence.

No association was demonstrated between disease severity and salon conditioning and frequency of relaxing (Table 6.4). The use of ordinal logistic regression to identify determinants

for disease severity yielded unreliable figures (not reported) possibly because of few cases with severe TA. Further, although the recommended frequency of relaxing is usually 6-8 weeks, there was an error in our questionnaire only noted at analysis i.e. the cut off point was 7 instead of 8 weeks.

Discussion

This study found an increased odds of TA presence in adults compared to children. Since school rules restricted the number and types of hairstyles in children, using three different hairstyle variables was more informative in adults than in children. TA prevalence in natural short hair in adults was significantly higher than that in school girls, (22% vs. 5.2%), which most likely indicate confounding from previous hairstyles and a longer history of hairdressing.

The odds of TA in natural hair + traction (braids with/without extensions or dreadlocks) was increased [OR 2.28 (P=0.005 95% CI 1.28-4.06)]. Because of small numbers the groups were combined in the latter regression analysis. However, the adult study had reported lower TA prevalence with dreadlocks compared to natural hair in braids + extensions (Table 6.1), possibly suggesting that traction from artificial extensions may cause more damage than that from natural long hair. However this finding requires confirmation. It was also interesting that TA prevalence in dreadlocks was similar to that of s-curl/perm and natural hair. The latter may suggest that the baseline risk of disease presence in African females is similar when traction is avoided in chemically treated hair and vice versa. However, because dreadlocks could not analyzed separately, it was not possible to confirm latter even though the odds of TA presence increased with all hairstyles, except s-curl/perm group compared to natural short hair, on univariate and in most categories of multivariate analyses.

The past history of multiple hairstyles in older participants may explain why on multivariate analysis the odds of TA was only increased in the 'traction attached to relaxed hair' category of the "usual hairstyle" model. In other words multiple previous hairstyles masked the differences between categories. In addition recall bias associated with the cross sectional nature of the study design may have influenced outcomes. In an attempt to reduce this bias the variables "current hairstyle" and "hairstyle on examination" were also included. However the increased risk of TA presence when traction was added to relaxed hair was a consistent finding,

demonstrated in the "current" hairstyle model (with similar consistency in the 'combined' category of the "hairstyle on examination" model).

The finding of the highest odds of TA when traction was added as extensions or weaves to relaxed hair suggests that the degree and duration of traction applied influence the risk of disease. Braid extensions and weaves are usually left in the hair for longer than two weeks whereas the traction associated with back combing and ponytails in long straight hair is usually intermittent (e.g. combing done for going out and ponytails are usually kept in for the day).

Where and how frequently the hair was relaxed, whether or not salon deep conditioning was done between relaxing, how much money was spent per hairdressing session and whether hair dye had ever been used did not alter the odds of TA presence. Although an error in coding categories of how frequently hair was relaxed was made, this is unlikely to have influenced our results, in view of few participants with severe decease. In addition, although the quality of hair care e.g. daily regimen, relaxing properly vs. over processing, and amount of traction with braids etc may influence disease presence and severity. It was not possible to make these assessments in this study. The validity of the effectiveness of frequency of relaxing and salon deep conditioning, on hair quality, can better be evaluated in prospective controlled trials.

Although the effect of symptom severity to disease presence seemed similar for braids and chemicals i.e."tight braids" vs. "tight braids resulting in pimples" and for "stinging from relaxer" and "stinging from relaxer resulting in crusts" respectively, the latter was insignificant. The odds of TA of presence was increased in participants with hairdressing symptoms after controlling for age and symptoms from braids maybe more harmful. It is note worthy that only 18.9% (54/286) of TA patients had no history of hair dressing symptoms. These findings suggest that avoiding inducing any symptoms during hairdressing may be important for disease prevention.

This study has demonstrated an association between greater TA severity and age group, hairstyle on examination and symptoms during hairdressing. Although the M-TAS score developed for the study was tested for reliability, examiners who participated in testing the tool were few, as described in chapter 5. Further the small number of participants with severe disease in this study may have been inadequate to detect a difference in TA severity between hairstyles. In an attempt to minimize error by eliminating inter observer variability all female participants in both population studies were examined by one dermatologist (NPK) including

severity assessment. The latter could potentially have introduced bias, in addition the M-TAS score requires validation with large numbers.

We have confirmed the cumulative effect on TA presence of applying traction to chemically treated hair. The coexistence of more than one cause of cosmetic alopecia has been suggested previously.[7] In addition a higher TA prevalence is suggested when extensions are added to braided natural hair (i.e. traction from synthetic fibers) compared to that from natural long hair (dreadlocks); but this requires confirmation with larger numbers.

The difference in the prevalence of TA between African males and females is consistent with a causal association with hairstyles. Hairstyle related pulling forces are thought to cause mechanical damage to hair follicles. This results in traumatic inflammation often diagnosed clinically as folliculitis, presenting as follicular papules and pustules in areas of traction[8,9] but may be subclinical. Repeated damage to the follicle may result in reduced hair growth.

The view that long standing TA eventually becomes "permanent" is a sentiment often repeated, and surgical treatment has been offered.[10,11] However this outcome of long-standing TA has not been confirmed in large histological studies and a recent comprehensive review classified "chronic" TA under non cicatricial alopecia.[12] In addition there is anecdotal report of response of long standing TA to topical minoxidil.[13] In order to advise patients, hairdressers and the public; we need more studies to test prevention strategies and investigate the possible effectiveness of treatment in chronic disease. Current evidence suggests that avoiding both inflicting symptoms during hair dressing and the addition of traction, especially to chemically processed hair, may reduce the risk of TA development.

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Table 6.1

Traction alopecia prevalence by usual hairstyle, in females, from the adult community groups

Variable		Frequency (%)							
TA present	**Total**	**Natural**	**Natural + braids**	**Natural + braids + extensions**	**Natural dread locks/twists**	**Relax straight long**	**Relax + braid extensions or weaves**	**Relax short (S-curl)**	**Perm**
Yes	175	25 (21.6)	5 (33.3)	9 (39.1)	3 (23.1)	91 (35.4)	25 (48.1)	3 (20.0)	11 (19.3)
No	462	91 (78.5)	10 (66.7)	14 (60.9)	10 (76.9)	166 (64.6)	27 (51.9)	12 (80.0)	46 (80.7)
Total	637	116	15	23	13	257	52	15	57
***Coding**		**Natural short**	**Natural + Traction**			**Relax long**	**Relax + Traction**	**S-curl/Perm**	

* Coding to create fewer groups for current analysis, used for both "usual" and "current" hairstyle regression models (please see later)

Table 6.2 Logistic regression analyses for Traction Alopecia presence

Variable	N	Univariate analysis			Controlling for age group (adults age =>18 years)		
		OR	P-value	95% CI	OR	P-value	95% CI
Age categories (years)							
*< 18**	*257**						
18-25	*341*	1.40	0.109	0.928-2.103			
25-50	*241*	2.47	<0.001	1.631-3.756			
>50	*191*	1.95	0.003	1.249-3.058			
Current hairstyle (1)							
*Natural short**	*277**						
Natural + Traction	*69*	2.40	0.003	1.351-4.267	2.28	0.005	1.279-4.055
S-curl + Perm	*70*	0.79	0.511	0.387-1.602	0.78	0.504	0.385-1.599
Relax (long)	*547*	1.54	0.017	1.080-2.193	1.70	0.004	1.189-2.445
Relax + Traction	*63*	3.60	<0.001	2.021-6.431	3.47	0.000	1.941-6.203
Usual hairstyle (2)							
*Natural short**	*158**						
Natural + Traction	*61*	1.71	0.112	0.882-3.328	1.70	0.119	0.872-3.304
S-curl + Perm	*112*	0.87	0.666	0.475-1.609	0.91	0.755	0.492-1.674
Relax (long)	*612*	1.34	0.175	0.878-2.049	1.50	0.065	0.975-2.299
Relax + Traction	*80*	1.93	0.032	1.057-3.522	2.03	0.021	1.110-3.726
Hairstyle on examination (3)							
*Natural short**	*297**						
Relax	*685*	2.34	<0.001	1.618-3.391	2.36	<0.001	1.627-3.419
S-curl +Perm	*61*	1.83	0.082	0.093-3.621	1.65	0.154	0.830-3.271
Other (combined)#	*103*	4.23	<0.001	2.533-7.070	3.78	<0.001	2.251-6.352
Money spent							
*>= R100**	*165**						
R50-R99	*209*	0.93	0.756	0.594-1.460	0.96	0.877	0.614-1.516
<50	*165*	0.67	0.044	0.450-0.988	0.74	0.149	0.498-1.112
Ever dyed							
*Yes**	*285**						
No	*628*	0.96	0.778	0.701-1.304	0.99	0.948	0.724-1.352
Hairdressing symptoms							
No symptoms*	*280**						
Tight/painful braids	*161*	1.94	0.004	1.243-3.029	2.02	0.002	1.290-3.158
Tight braids + pimples	*73*	1.81	0.046	1.009-3.229	1.98	0.022	1.102-3.565
Stinging relaxer	*470*	1.45	0.044	1.011-2.084	1.60	0.012	1.108-2.306
Stinging relax + crusts	*160*	1.30	0.269	0.815-2.085	1.41	0.155	0.878-2.265

* Baseline category

**Hairstyle variables included: Participant chosen "usual" and "current;" examiner recorded "hairstyle on examination"

Combined hair styles (i.e. natural/s-curl/ relaxed combined with braids with/without extensions/weaves)

S-curl = short relaxed (textured hair); perm = permanent wave [both usually styled as loose curls/waves]

Table 6.3 Traction alopecia severity by patient characteristics in females

Variable	Frequency (%)			
	Total	**Mild**	**Moderate**	**Severe**
Age group				
Children (<18 years)	45	36 (80.0)	9 (20.0)	0 (0.0)
Adults (=>18 years)	241	147 (61.0)	85 (35.3)	9 (3.7)
Total	286	183 (64.0)	94 (32.9)	9 (3.2)
P-value[a]				**0.011**
Current hairstyle				
Natural short	53	28 (52.8)	20 (37.7)	5 (9.4)
Natural + traction	25	12 (48.0)	11 (44.0)	2 (8.0)
S-curl+Perm	11	6 (54.6)	5 (45.5)	0 (0.0)
Relax (,long)	146	106 (72.6)	40 (27.4)	0 (0.0)
Relax + traction	29	16 (55.2)	11 (37.9)	2 (6.9)
Total	264	168 (63.6)	87 (33.0)	9 (3.4)
P-value[a]				**0.021**
Usual hairstyle				
Natural short	33	16 (48.5)	13 (39.4)	4 (12.1)
Natural+ traction	19	12 (63.2)	6 (31.6)	1 (5.3)
S-curl+Perm	21	12 (57.1)	8 (38.1)	1 (4.8)
Relax long	160	117 (73.1)	42 (26.3)	1 (0.6)
Relax + traction	27	12 (44.4)	14 (51.9)	1 (3.7)
Total	260	169 (65.0)	83 (31.9)	8 (3.1)
P-value[a]				**0.126**
Hairstyle on examination				
Natural short	41	22 (53.7)	16 (39.0)	3 (7.3)
S-curl + Perm	14	8 (57.1)	6 (42.9)	0 (0.0)
Relax long	189	131 (69.3)	56 (29.6)	2 (1.1)
Combined	42	22 (52.4)	16 (38.1)	4 (9.5)
Total	286	183 (64.0)	94 (32.9)	9 (3.2)
P-value[a]				**0.590**
Hairdressing symptoms				
No symptoms	54	27 (50.0)	24 (44.4)	3 (5.6)
Tight braids	51	27 (52.9)	20 (39.2)	4 (7.8)
Tight braids & pimples	22	13 (59.1)	9 (40.9)	0 (0.0)
Stinging relaxer	121	87 (71.9)	33 (27.3)	1 (0.8)
Stinging relaxer & crusts	38	29 (76.3)	8 (21.1)	1 (2.6)
Total	286	183 (64.0)	94 (32.9)	9 (3.1)
P-value[a]				**<0.001**

*Values are count/total (proportion). Denominators differ due to missing values.

[a] p-value based on Wilcoxon rank-sum test for ordered groups.

** Combined: refers to combinations (natural, relaxed, or permed AND cornrows, braids, extensions or dreadlocks)

Table 6.4 TA severity in subgroup of females with relaxed hair

Variable	Frequency (%)			
	Total	Mild	Moderate	Severe
How often hair relaxed?				
< 5 weeks	59	46 (78.0)	13 (22.0)	0 (0.0)
5- 7 weeks	43	27 (62.8)	14 (32.6)	2 (4.7)
>7 weeks#	22	16 (72.7)	6 (27.3)	0 (0.0)
Total	124	89 (71.8)	33 (26.6)	2 (1.6)
P-value[a]				**0.080**
Salon conditioning between relaxing				
Yes	99	64 (64.7)	33 (33.3)	2 (2.0)
No	48	37 (77.1)	11 (22.9)	0 (0.0)
Depends on money	31	20 (64.5)	11 (35.5)	0 (0.0)
Total	178	121(68.0)	55 (30.9)	2 (1.1)
P-value[a]				**0.359**

*Values are count/total (proportion). Denominators differ due to missing values.

[a] p-value based on Wilcoxon rank-sum test for ordered groups.

Often recommended frequency of relaxing 6-8 weeks, cut off error in questionnaire 7 weeks

Chapter 7

Dissertation discussion

The assertion that specific scalp disorders are common in individuals of African ancestry has not previously been confirmed in population studies.[1] Prior to the publication of the studies from this thesis[2,3] only data from clinic studies estimating the prevalence of acne (folliculitis) keloidalis (AKN) and traction alopecia (TA) and none estimating the frequency of central centrifugal cicatricial alopecia (CCCA) had been published. The differences between the prevalence reported in clinic studies and this thesis confirmed that the former are likely to be subject to selection bias.

The majority of Langa Township residents keep up with fashionable hairstyles. The latter is likely to be consistent with fashion trends in the African continent and the Diaspora. More girls had chemically treated hair than women (78% vs. 58.7%) respectively. About three quarters of males have frequent haircuts to maintain the fashionable "close shave look".

For many years a causal association between hairdressing and hairstyles has been suspected. AKN and CCCA in the data from this thesis were more prevalent in the > 50-75 years than the > 75 years group, which for scarring conditions, suggests external rather than degenerative aetiological factors. The latter finding however requires confirmation. Disease predictors were only calculated for TA, the most prevalent of the above conditions, and the odds of TA presence in females was demonstrated to be associated with increasing age and specific hairstyles.

Summary of limitations

The biggest problem in the study of cosmetic alopecia is that many sufferers have used multiple hair grooming procedures[4,5] over a long period of time, so that establishing a cause-and-effect link is often difficult. There is a paucity of published data on the scalp conditions of interest in this thesis. Measurements of disease occurrence performed in clinics and special groups (e.g. soccer clubs) are less generalisable than data from the general population. This limitation may apply to some extent to the data from our adult study which because of lack of funding was

conducted in specific community groups.

In an attempt to reduce bias four different community groups were included (traditional and independent churches, cultural groups and hostel dwellers). The data from the school study are likely to be more generalisable not only because of the random selection of schools but also the wide spectrum of age groups included (from the first year of primary to last year of high school). All study participants except for the males in church group 2 were examined by one dermatologist. Although the latter reduces inter observer variability, it may have introduced bias inherent to the examiner.

Acne keloidalis nuchae

The prevalence of AKN was much higher in adult males that boys and females. A trend was demonstrated with hair that is kept very short. A recent haircut (< 4 weeks) in the study was used as a surrogate for frequent haircuts. However, during discussions with participants many mentioned that they had a haircut not monthly but two weekly. The latter frequency might have been more sensitive in picking up an association between cut hair frequency and AKN. Most males reported a recent haircut < 4 weeks previously (72 % of boys[2] and 78% of men[6]). It was noteworthy that AKN prevalence did not change with type of instrument used to cut the hair but did change with hair cut symptoms.

Close shave frequent haircuts are currently popular with Africans in our population and throughout the Diaspora, variably referred to as "clean shave," "shave look" and, especially in apartheid established peri-urban townships, the "chiskop." The majority of electric clippers used for hair cuts are either cleaned with a brush or sprinkled with methylated spirits, and are not sterilized between clients. In addition, although manufacturers supply clippers with plastic stages of various widths to give hair cuts of various lengths, these are often not used. This is because the closest shave can only be achieved when the metal of the clipper is in direct contact with the scalp and the hair cut against the grain. This gives a haircut as close as that achieved with razor blades, which are also still used by some.

Considering the popularity of very close shave haircuts it seems plausible that raised pimples, in AKN patients, could form an irregular surface resulting in accidental injury with the commonly used electric clippers. What is not clear is whether in healthy people shave haircuts

cause AKN. Although the pathogenesis of AKN is still unclear it shares similarities in the type of lesions and predominance in Africans with another condition - pseudofolliculitis barbae (PS). The lesions of PS, commonly called beard 'razor bumps' are thought to be the result of in-growing hairs. It has been proposed that AKN is a primary scarring alopecia with no evidence of in-growing hairs.[7]

The symptoms associated with haircuts in chapter 4 were not limited to participants with AKN. A recent Nigerian study reported that AKN accounted for 9.4% of their dermatology outpatients, all were male and in most the onset was thought to be secondary to haircut trauma.[8] It reasonable to speculate that close shave haircuts may contribute to the pathogenesis of this disease. The latter is consistent with standard dermatology practice to advise AKN patients to avoid close shave haircuts. This association between haircut symptoms and AKN needs further study to clarify whether it is causal.

More importantly, the combination of susceptibility to AKN and a prevalent, potentially injurious, behaviour (frequent short haircuts) in African males raises the question of potential blood borne disease transmission**.** There is a need to clarify hairdressing symptoms and determine if there is any of risk of viral infection transmission. The latter could include direct (evidence of macroscopic/microscopic bleeding and viral DNA) and indirect (e.g. case control, cohort studies) approaches.

The risk of viral transmission per hair cut performed with a contaminated instrument is likely to be low but should be quantified. Although other skin penetrating procedures (traditional scarification, body piercing and tattoos) can also potentially transmit viral disease this has not been a significant route. For example, tattoos have been shown to have a significantly higher risk of viral hepatitis[9,10] but not of HIV. It has been suggested that sexual transmission accounts for about 90% of HIV infections.[11] A World Health Organization report estimates HIV infections attributable to needle stick injuries among health care workers to be about 4.4% - a tiny contribution to population HIV figures.[12] Thus if the above figures are reliable, there maybe HIV infections unaccounted for by currently studied methods of disease transmission.

Traction alopecia

The prevalence of TA in chapters 3 and 4 were higher in girls than in boys and highest

in adult women (31.7%). The traction applied to long straight hair is intermittent (for example back combing and ponytails that are kept for a day). Traction in "combined" hairstyles is usually applied for longer than two weeks (braids, extensions and weaves). The short waves of s-curls and curls of permed hair are usually styled loosely which may explain the lower prevalence of disease than that associated with relaxed long hair. Similarly this also explains the highest prevalence TA (48%) when long term traction (braid extensions, weaves) was applied to relaxed hair

The M-TAS score was successfully developed for estimating TA severity. It appears to be a reliable tool for measuring disease severity but not for disease diagnosis. It was interesting to note that although TA prevalence is very high in our adult female population, severe disease is rare [only 18/286 i.e. (6.3%) TA patients had severe TA].

The highest risk of TA presence, compared to natural short hair, occurred when traction was added to relaxed hair. Although not quantified there is recognition that 'repetitive hair-relaxing treatments … weaken the hair structure. Therefore hair breakage is a common feature.' [14] In addition chemical damage of hair has been shown, in *in vitro* studies to result in increased fibre fragility.[15] This suggests that relaxed hair is less resistant to traction predisposing it to a higher risk of developing TA than natural hair.

Chapters 3 and 4 demonstrated an increased risk of TA presence in participants who experienced symptoms during hair dressing. In addition the significantly increased TA risk in participants who attached artificial extensions to natural hair compared to those who wear their hair as dreadlocks suggests that exogenous traction maybe more damaging than that which is endogenous.

Different types of hair extensions are available. Some are made of shiny nylon and others appear and are advertised as "natural hair" (presumable of Asian origin). Further studies are needed to determine whether TA prevalence varies with the type of extension used. It is still unclear whether certain Africans are more predisposed to developing TA – whether this might vary with hair texture or other genetic variables.

Braids are important expressions of culture for Africans. Interventions that reduce and preferable eliminate TA while allowing cultural expression would be ideal. Thus studies investigating whether it is possible to produce aesthetically pleasing braids without inducing

pain or predisposing people to TA are necessary.

Central centrifugal cicatricial alopecia

Adverse effects from relaxers can result from the poor skill of the hair dresser, e.g. if the relaxer is applied for longer than recommended, or not properly neutralized or rinsed. Abuse can also be as result of clients going too frequently for repeat treatments (< recommended 6-8 weekly) although good hair dressers should discourage this practice. It has been suggested that "permanent hair loss is highly unlikely with hair restructuring products because … (they) do not destroy the follicular unit."[13] However other anecdotal reports have linked hair relaxers with permanent hair loss[14,15] specifically CCCA like scarring alopecia.[4,15]

CCCA is a scarring form of alopecia more commonly reported in females, rarely males, of African ancestry. A causal link with the use of the 'hot comb' was initially suspected and later disproved.[16] The name 'follicular degeneration syndrome' was proposed when it was reported that premature desquamation of the inner root sheath of the hair follicle was the earliest histological finding, although this may not be specific.[17]

The usually insidious onset of CCCA makes it difficult to work out a causal link, which may turn out to be multifactorial - with possible contribution from chemicals, traction and the curly nature of African hair follicles. However a recent report of CCCA-like acute scarring secondary to relaxer use is the closest link to date.[18] Hair relaxers straighten hair by breaking down the disulphide bonds between keratins that maintain the tight curls. Theoretically relaxers could break down not only disulphide bonds in the hair but also those within the superficial cell layers of the scalp, resulting in inflammation.

Filaggrin, an important marker for epidermal differentiation, is involved in aggregation of keratin filaments which are rich in cross linked disulphide bonds, similar to the process occurring in the differentiation of hair. Although the structures of cytokeratin and trichocyte keratin intermediate filaments appear to be different from each other, there is some evidence of co-existence of trichohyalin and fillagrin expression in the epidermis in a number of normal (e.g. filiform papillae of tongue, neonatal foreskin) and hyperplastic diseased skin.[19] These findings demonstrate that trichohyalin is not peculiar to hair follicle cells, but is expressed in a number of normal and pathological epithelia. Thus, the latter biochemical overlap may result

in similar responses to chemicals, e.g. the breakdown of disulphide bonds in scalp epidermis during hair chemical relaxation which could potentially induce inflammation and the scarring typical of CCCA in susceptible individuals. Studies comparing amino acid analysis in natural and chemically relaxed (and damaged) hair may shed more light on this.

Our finding of a trend toward higher disease prevalence in participants who have had relaxed hair for > 5 years vs. =< 5 years needs confirmation. In addition, case control studies may be more reliable as they are able to include more participants with CCCA including those with severe disease. In this study only 16 out of 604 adult females and none of 574 girls in the school study had the condition.

Conclusions

This thesis has demonstrated that TA/CCCA and AKN are common in African females and males respectively and that these diseases are more common in adults than children. Although AKN was associated with haircut symptoms, the influence of frequency of haircut requires further study. Haircut symptoms in males, especially bleeding, may have implications for blood borne disease transmission and needs further investigation. CCCA is commoner in females older than 50 years, may be associated with hair relaxed for longer than 5 years, and its association with hairdressing requires further study.

TA was clearly associated with hairstyles. In children, who had restriction on the number and variety of hairstyles, it was more common in participants with relaxed than in those with natural hair. In adults the prevalence was lower with relaxed long straight hair than relaxed hair that had extensions/weaves attached; suggesting that intermittent traction associated with the former maybe less damaging than the prolonged traction of the latter. In addition, traction from artificial extension on natural hair was associated with a higher prevalence of TA than that from natural hair (i.e. dreadlocks). Although TA prevalence was similar with natural short hair, s-curl/permed and dreadlocks the odds of TA presence were higher with dreadlocks than with the other two groups. The latter similarity may suggest confounding (history of different hair styles) and that the baseline risk of disease presence in African females is similar when traction is avoided in chemically treated hair and vice versa. The lower odds of disease in the s-curl/permed group is possibly explained by the fact that both are usually styled with no traction

applied.

TA presence had a higher odds in participants with a history of hairdressing symptoms (tight braids and chemical burns from relaxers) and TA severity was associated with usual hairstyle and symptoms. Avoidance of inducing any symptoms during hairdressing and of the addition of traction to relaxed hair may thus be important in disease prevention.

Public health and implications

The public health implications of the findings on this thesis are intuitive, i.e. avoid and stop any hair procedure that induces pain of discomfort. There are prevalent myths about hairdressing such as: "tight braids last long" and "the longer the chemical relaxer is left on the hair during processing the straighter the hair will be." The sight of someone who has had tight braids done and is in such pain that she wears a wet head scarf or takes a few doses of pain killers is not uncommon. In the quest for long hair others will bear the stinging relaxer for as long as possible before allowing the hairdresser to neutralize and rinse the hair. However, changing such behaviour is a complex process.

Firstly we need to show that these conditions are indeed a health problem. The clinical reports of patients presenting with hair and scalp disorders is proof, but this needs to be quantified. Both men and women with severe scalp disease cover their heads in public – so that the unsightly lesions are not visible to others. An education campaign that targets both hair dressers and the public needs to make both groups aware of severely affected cases.

Secondly, once people are aware of the damage that hairstyles can cause campaigns to change behaviour have a better chance of succeeding. This is a complex cultural and political issue. For example, braids have been popular in Africa longer than we know. It is not possible to suggest that braids should be stopped. In addition braids are a beautiful art form. It is likely that avoiding any symptoms associated with braids may allow people to continue practicing this art form without inducing disease. The need for more population studies in which consumer groups not only participate but have a say e.g. about prevention strategies, could be helpful.

The use of hair relaxers is more complicated. While some insist they relax their hair for easy grooming, we know that relaxers have also been used to obtain political "race reclassification" as discussed in chapter 1 of this thesis. Although relaxers do allow the African

hair to grow longer than natural hair, the difference is not dramatic, i.e. the lengths reached are no where near those of the hair of people of Asian or European ancestry.[20] This may explain the more recently popular use of weave extensions which look like Asian and European hair. In addition, particularly in America and Johannesburg others use not only blonde weaves but also blue and green contact lenses. How much of this is fashion or an expression of identity issues is unclear. The reason why people make the choices they make about the hair is not the subject of this thesis. However understanding why such choices are made is important for disease prevention.

The public needs to be empowered to insist that hair dressers do not cause pain when handling their hair. Slogans and catch phrases such as "pain is a warning, damage is being caused" may be useful. In addition healthcare workers also need to be aware of what can be done to prevent hair and scalp disease. Doctors in particular, need to be educated to be culturally sensitive and non judgmental in their dealing with hair loss patients. The common advice given to TA patients to "stop all braids" is outdated. It may be possible to both maintain culture and prevent disease. It is thus necessary to design studies that will help elucidate effective preventative strategies.

This thesis has not fully addressed AKN and CCCA. However the possible association between AKN with not only hair cut injuries but the possibility of viral disease transmission warrants urgent study. In the mean time it might be prudent to advice males who prefer shave haircuts to either acquire their own hair clipper (these are inexpensive about 200 South African Rands) or to use chemical depilatory.

Hopefully the result of this thesis will stimulate more studies that will investigate hairdressing associated African hair disorders. A reduced prevalence of scalp disease and the attainment of "healthier hair" for African populations seem achievable.

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Annexure 1

Attached is the adult questionnaire that was used for the churches. The one used for other community organizations was the same except for the sections referring to the relevant member or organization.

Several questions that were not in the children's questionnaire came up during field work and were later included in the adult questionnaire. These are questions 22b and 22c.

This study investigated research questions beyond the confines of this thesis.[1] Unrelated sections have been removed from the included data collection tool. However some questions that are not directly related are left in for continuity.

Reference

Khumalo NP, Gumedze F. African hair length in a schoolpopulation: a clue to disease pathogenesis? *J Cosmet Dermatol*2007;**6**(3)**:**144-51.

Adult QUESTIONNAIRE (Churches)

Langa Survey on hair trends and hair and scalp disorders

Icawe / Church: _____

Igama / Name**:** _____ **Ifani /**Surname: _____

Usini sakho/sex: **Ubhuti/Tata /**Male **Imama/Sisi /**Female

Usuku lokuzalwa/ Birthday: _____

Address yasekhaya/Home address: _____

Ukuba iminyaka yakho ingaphezu kwe 18years ungazityikityela imvume yokuxilongwa/If you are over the age of 18 years you can sign your own consent to participate in this study: _____

_____

Zibaluleke kanganini iinwele zakho kuwe? Khetha inani ukusuka ku 1 ukuya ku 10. (Apho u 10 = kakhulu gqitha, 5 = njee, 1 = azibulekanga tu)

How important is your hair to you? On a scale of 1-10, where 10 = of utmost importance, 5 = of average importance and 1 = not important at all.

2. Xa uthelekisa nempahla ungathi iinwele zibalule kangakanani empahleni?

Compared to clothes, would you say that your hair is

- ❑ **A. Ngokufanayo /**Equally important
- ❑ **B. Ngaphezulu/**More important
- ❑ **C. Ngaphantsi/**Less important

3. Uyazithanda iinwele zakho/Are you happy with your hair, in general**?**

- ❑ **A. Ewe/**Yes
- ❑ **B. Hayi/**No

4. Ingaba ikhona na inxhaki nenwele zakho? /Are there any complaints you have with your hair**?**

- ❑ **A. Kubuhlungu ukukama/**pain when combing
- ❑ **B. Azikhuli zibende/**Not growing long
- ❑ **C. Okunye? nceda ubhale/** Other? Please write
- ❑ **D. Hayi/**No

5. Ucinga intlonze yakho isempilweni/ Do you see your scalp (hair) as healthy**?**

A. Ewe/Yes

B. Hayi/No

6. Ingaba ikhona onayo NGOKU kwezilandeyo? Nceda ukhethe

Do you have had any of the following now? If so please tick

- ❑ **A. Inkwethu/** dandruff
- ❑ **B. Izitshangubo/**ringworm
- ❑ **C. Ukurhawuzela/**itch
- ❑ **D. Amaqhakuva/**pimples
- ❑ **E. Izilnda/**sores
- ❑ **F. Amatshanda/**bold patches
- ❑ **G. Ukuwa kwenwele/**hair breakage

7. Ingaba ikhona okhewanayo NGAPHAMBILI kwezilandeyo? Nceda ukhethe/ Have had any of the following before?

- ❑ **A. Inkwethu/** dandruff
- ❑ **B. Izitshangubo/**ringworm
- ❑ **C. Ukurhawuzela/**itch
- ❑ **D. Amaqhakuva/**pimples
- ❑ **E. Izilonda/**sores
- ❑ **F. Amatshanda/**bold patches
- ❑ **G. Ukuwa kwenwele/**hair breakage

8. Uchitha ixesha elingakanani ulungisa inwele zakho NGEMINI?/How much time do you spend on your hair each DAY?

- ❑ **A. < 15 minutes**
- ❑ **B. 15 – 30 minutes**
- ❑ **C. >30 but < an hour**
- ❑ **D. An hour or more**

9. Iinwele zakho zenziwe ntoni ngoku? What hair style do you have now?

- ❑ **A. Natural**
- ❑ **B. Natural +cut**
- ❑ **C. Natural + cornrow**
- ❑ **D. Natural + cornrow (+extensions)**
- ❑ **E. Natural + singles**
- ❑ **F. S-curl + cut**
- ❑ **G. Relax**
- ❑ **H. Relax + hair piece**
- ❑ **I. Relax + cornrow (no extensions)**
- ❑ **J. Relax + cornrow (+extensions)**
- ❑ **K. Relax + singles**
- ❑ **L. Twists (or dreadlocks)**
- ❑ **M. Perm**
- ❑ **N. Enye nceda uyibhale/**Other please specify

10. Iinwele zakho zigqele ukwenziwa ntoni? What hair style do you usually have?

- ❑ **A. Natural**
- ❑ **B. Natural +cut**
- ❑ **C. Natural + cornrow**
- ❑ **D. Natural + cornrow (+extensions)**
- ❑ **E. Natural + singles**
- ❑ **F. S-curl + cut**
- ❑ **G. Relax**
- ❑ **H. Relax + hair piece**
- ❑ **I. Relax + cornrow (no extensions)**
- ❑ **J. Relax + cornrow (+extensions)**
- ❑ **K. Relax + singles**
- ❑ **L. Twists (or dreadlocks)**
- ❑ **M. Perm**
- ❑ **N. Enye nceda uyibhale/**Other please specify

11. Inwele zakho ziqhele ukwenziwa phi? Where do you usually have your hair done?

- ❑ **A. Esaluni/**saloon
- ❑ **B. Kumntu ochebayo/**barber
- ❑ **C. Ekhaya okanye kummelwane/**at mine or neighbour's house

12. Yimali oyichitha ezinweleni ngenyanga? How much money do you spend on your hair per month?

- ❑ **A. R0 – R19**
- ❑ **B. R20 – R49**
- ❑ **C. R50 – R99**
- ❑ **D. R100 – R199**
- ❑ **E. > R200**

13. Ukuba uyarelaxer okanye perma uthatha ixesha elingani phambi kokuba uphinde?/If you relax or perm your hair, often do you do it?

- ❑ **A. 1-2 weeks**
- ❑ **B. 3-4 weeks**
- ❑ **C. 5-7weeks**
- ❑ **D. 2-3months**
- ❑ **E. >3months**
- ❑ **F. Kuyaxhomekeka -xakukho imali/**depends, when there is money available
- ❑ **G. Kuyaxhomekeka – xakukho igrowth/** depends, when there is new hair growth

14. Ukuba uyarelaxer okanye perm uyayenza itreatment phambi kokuba uphinde urelaxe/perm?/ If you relax/prem your hair do you treatment in between relaxing/perming?

- ❑ **A. Ewe /yes**
- ❑ **B. Hayi / no**
- ❑ **C. Kuyaxhomekeka -xakukho imali /**It depends on availability of money

15. Yeyiphi kwezilandelayo ekhe yenzeka kuwe xa usenziwa iinwele? When having your hair done which of the following have you experienced before?

- ❑ **A. Amaqakuva (emva entloko)AKHE aphume xandisandukucheba/I sometimes have pimples (at the back of head) soon after a hair cut**
- ❑ **B. Amaqakuva AQHELE ukuphuma xandisandukucheba/I usually have pimples (at the back of head) soon after a hair cuts**
- ❑ **C. Amaqakuva (emva entloko)ASOLOKU EKHONA/I always have pimples (at the back of head).**
- ❑ **D. Ngikhe ndibesikhakha xandisandukucheba/ I sometimes have scale soon after hair cut**
- ❑ **E. Andikendibe namaqhakuva emva entloko/I do not get pimples at the back of my head.**

16. Ukuba wenze irelax/perm NGOKU usebenzise eyiphi iproduct? If your hair is relaxed/permed now, what product have you used?

- ❑ **A. Soft and free**
- ❑ **B. Revlon realistic**
- ❑ **C. Sunsilk**
- ❑ **D. Restore plus**
- ❑ **E. Dark and lovely**
- ❑ **F. Black like me**
- ❑ **G. Stay sofro**
- ❑ **H. Caival**
- ❑ **I. Enye, nceda uyibhale /** Other please write

17. Ukuba wakhe wenza irelax/perm NGAPHAMBILI wawusebenzise eyiphi iproduct? If your hair was relaxed/permed before, what product did you use?

- ❑ **A. Soft and free**
- ❑ **B. Revlon realistic**
- ❑ **C. Sunsilk**
- ❑ **D. Restore plus**
- ❑ **E. Dark and lovely**
- ❑ **F. Black like me**
- ❑ **G. Stay sofro**
- ❑ **H. Caival**
- ❑ **I. Enye, nceda uyibhale /** Other, please write

18. Ucinga zikhonana izitayela ezimosha iinwele okanye intlonze?/ Do you think there are hair styles that damage hair or the scalp?

- ❑ **A. Ewe /**yes
- ❑ **B. Hayi /** no
- ❑ **C. Andazi/**Don't know

19. Ukuba zikhona zeziphi? Nceda ubhale/ If so which ones? Please write.

20a. Ukuba zikhona zizimosha njani? Nceda ubhale/ If so how do they cause damage? Please write.

20b. Khetha zonke okhe wazenza ngaphambili kwezilandelayo./ Choose from the following all the styles you have done before.

- ❑ **A. Ukuflerha inatural hair owani/** Natural + blocks (ropes of three's)
- ❑ **B. Ukuflerha inatural hair imigca/**Natural + cornrow
- ❑ **C. Ukuflerha inatural hair imigca ufakele ifibre/**Natural + cornrow (+extensions)
- ❑ **D. Ukuflerha inatural hair isingles ufakele ifibre/**Natural + singles
- ❑ **E. Ukuflerha irelax imigca/**Relax + cornrow (no extensions)
- ❑ **F. Ukuflerha irelax imigca ufakele ifibre/**Relax + cornrow (+extensions)
- ❑ **G. Ukuflerha irelax isingles ufakele ifibre/**Relax + singles
- ❑ **H. Relax + hair piece**
- ❑ **I. Twists (or dreadlocks) + Andikhe ndiflerhe okanye ndibophe/** Twists (or dreadlocks) NEVER styled or tied.
- ❑ **J. Twists (or dreadlocks) + ndikhe ndiflerhe okanye ndibophe /**Twists (or dreadlocks) + sometime styled or tied.

21. Ugqibele nini ukucheba?/ When was your last hair cut?

- ❑ **A. <1 month**
- ❑ **B. 2-5 months**
- ❑ **C. 6 – 11 months**
- ❑ **D. 1 - 2 years**
- ❑ **E. >2 and < 5 years**
- ❑ **F. >5 years**

22a. Ukuba uqhele ukuceba, khetha kwezilandelayo? If you usually cut your hair which of the following applies to you?

- ❑ **A. Ndiceba inqayi/**Usually have a clean cut
- ❑ **B. Ndiceba ibrush cut/**Usually have a brush cut
- ❑ **C. Ndiceba inqayi emva nasemacaleni/**Usually have the fade look

22b. Ukuba uceba inqayi uyiceba ngantoni?/If you usually have a clean cut what do you use?

- ❑ **A. Ngomatshini/** clipper
- ❑ **B. Ngeblade /** razor blade
- ❑ **C. Ngecream/** shaving cream
- ❑ **D. Ngomgubo odityaniswayo/** shaving powder

22c. Ukuba uceba inqayi ukhewopha?/If you usually have you ever bled?

- ❑ **A. Zange khendophe/** I have never bled
- ❑ **B. Ndikhe ndophe/** I sometimes bleed
- ❑ **C.Ndiqhele ukopha/** I usually bleed

23. Ukuba uqhele ukuceba, khetha eyinyani kwezilandelayo? If you usually cut your hair which of the following applies to you?

- ❑ **A. Amaqakuva (emva entloko)AKHE aphume xandisandukucheba/**I sometimes have pimples (at the back of head) soon after a hair cut
- ❑ **B. Amaqakuva AQHELE ukuphuma xandisandukucheba/**I usually have pimples (at the back of head) soon after a hair cut
- ❑ **C. Amaqakuva (emva entloko)ASOLOKU EKHONA/**I always have pimples (at the back of head).
- ❑ **D. Ngikhe ndibesikhakha xandisandukucheba/** I sometimes have scale soon after hair cut
- ❑ **E. Andikendibe namaqhakuva emva entloko/**I donot get pimples at the back of my head.

24. Ukhe uwujike umbala wenwele zakho/ Do you ever dye your hair

- ❑ **A. Ewe /**yes
- ❑ **B. Hayi /** no

Table 1 Clinical examination

General examination of participant, *i.e. looks:*	**Well** include	**Unwell** Exclude all			
26. Hair style:	A. Natural:	1. Combed	2. Dreadlocks	3. Twists	4. Plaits /cornrow
	B. Chemically treated:	1. Relaxed	2. Relaxed (S-curl)	3. Permed	4. Dyed
	C.Extensions:	1. Singles on a. Natural hair b. Relaxed hair	2. Cornrow on a. Natural hair b. Relaxed hair	3. Weave (glued) a. Natural hair b. Relaxed hair	4. Weave (stitched) a. Natural hair b. Relaxed hair
27. Hair condition:	A. Good (Healthy)	B. Mild abN (e.g. bit dry, discoloured)	C. Damaged (e.g. broken ,unequal lengths, severely discoloured, over processed)		
28. Scalp appearance	A. Healthy	B. Minor abN 1. dandruff, 2. greasy	C. Suggestive of clinical diagnosis (Qualify:) 1. TA, 2. AKN, 3. CCCA		

TA - traction alopecia, AKN – acne (folliculitis) keloidalis nuchae, CCCA – central centrifugal cicatricial alopecia